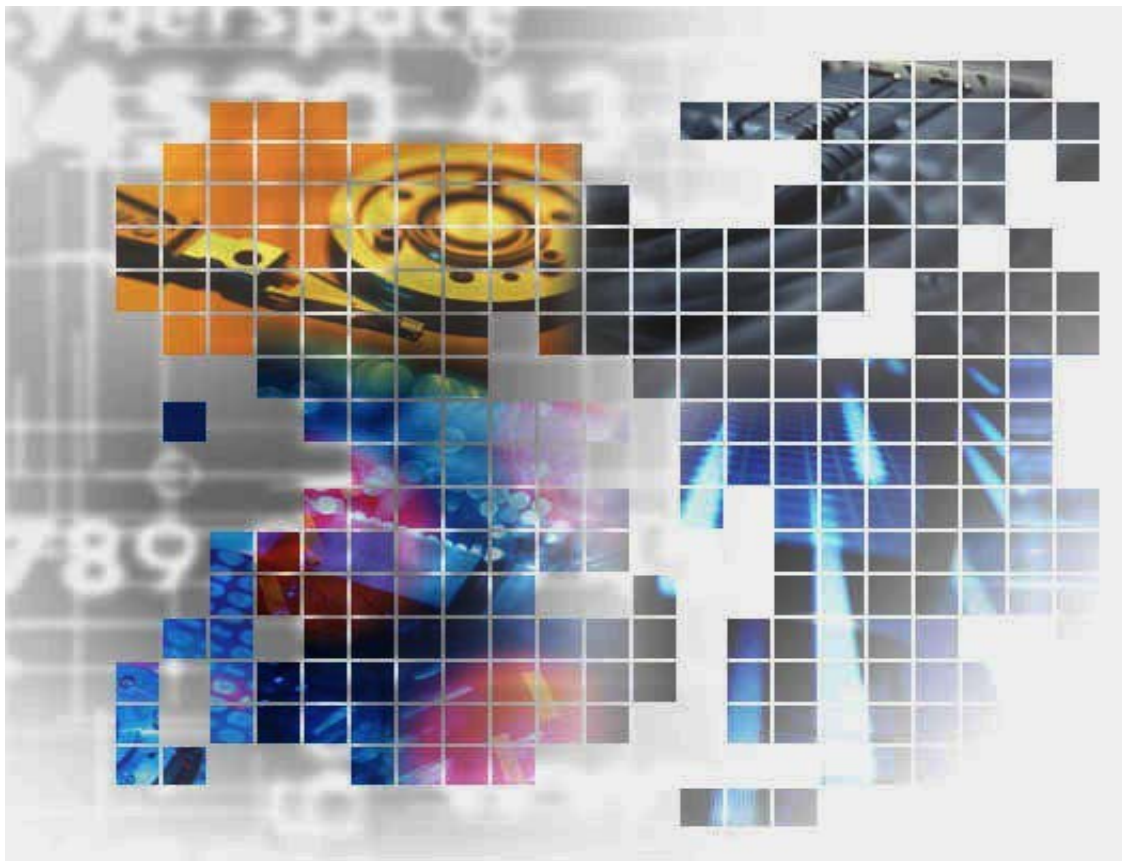


NEC Storage Manager

Data Replication User's Manual (Function Guide)



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Preface

This manual describes how to use the data replication function provided by NEC Storage DynamicDataReplication Ver2, NEC Storage RemoteDataReplication Ver2, and NEC Storage ReplicationControl.

The data replication function consists of the replication volume creation function provided in a disk array and software to manage and operate it. It utilizes replication volume to make business operation more effective.

Refer to the “NEC Storage Manager Manual Guide” (IS901) for the overview of NEC Storage and the related manuals. Refer to the “NEC Storage Manager Data Replication User’s Manual (Disaster Recovery System Installation and Operation Guide)” (IS027) for the usage of the remote data replication functions provided by NEC Storage RemoteDataReplication/DisasterRecovery and NEC Storage ReplicationControl/DisasterRecovery.

Remarks 1. This manual explains functions implemented by the following program products:

- NEC Storage Manager and NEC Storage BaseProduct
- NEC Storage DynamicDataReplication
- NEC Storage ReplicationControl
- NEC Storage RemoteDataReplication

2. This manual is applicable to the program products of the following versions:

- NEC Storage Manager Ver3.3
- NEC Storage BaseProduct Ver3.3
- NEC Storage ReplicationControl Ver3.3

3. The NEC Storage Manager is referred to as iSM or Storage Manager in the text of this manual.

Also, the NEC Storage series disk array subsystem is referred to as a disk array.

4. The following descriptions in the text of this manual refer to the corresponding products.

Description	Corresponding Product
Storage Manager	NEC Storage Manager
AccessControl	NEC Storage AccessControl
DynamicDataReplication	NEC Storage DynamicDataReplication
RemoteDataReplication	NEC Storage RemoteDataReplication
RemoteDataReplication/DisasterRecovery	NEC Storage RemoteDataReplication/DisasterRecovery
ReplicationControl	NEC Storage ReplicationControl
SnapControl	NEC Storage SnapControl

5. The following descriptions in the text of this manual refer to the corresponding manuals.

Description	Corresponding Manual
User's Manual (UNIX)	NEC Storage Manager User's Manual (UNIX) (IS001)
User's Manual	NEC Storage Manager User's Manual (IS004)
Configuration Setting Tool User's Manual (GUI)	NEC Storage Manager Configuration Setting Tool User's Manual (GUI) (IS007)
Data Replication User's Manual (Installation and Operation Guide for Windows)	NEC Storage Manager Data Replication User's Manual (Installation and Operation Guide for Windows) (IS016)
Data Replication Command Reference	NEC Storage Manager Data Replication Command Reference (IS021)

Description	Corresponding Product
Data Replication User's Manual (Disaster Recovery System Installation and Operation Guide)	NEC Storage Manager Data Replication User's Manual (Disaster Recovery System Installation and Operation Guide) (IS027)
Snapshot User's Manual (Function Guide)	NEC Storage Manager Snapshot User's Manual (Function Guide) (IS030)

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Be sure to observe the contents.

If the indications are ignored and the system is improperly operated, settings which have been already made might be affected.

Type of Indication	
Type	Description
	Describes contents which require special attention during operation.

The First Edition in March 2003

The Ninth Edition in November 2004

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Chapter 1 Data Replication Overview

To manage an enormous amount of information accumulated in business in a unified way and promote effective and efficient utilization of the information, a high-throughput, large-capacity, and high-reliability storage system is required. Data Replication provides functions to build and manage such a storage system.

This chapter describes overview of Data Replication, hardware configuration, and software configuration.

1.1 Data Replication

Data Replication is a function that creates Replication Volumes (RV) of a business volume (called Master Volume (MV) in the data replication). It is installed in the disk array. Replication volumes can be connected to or separated from the master volume at any time. Operations such as connection and separation can be instructed from the business server and the iSM Client (e.g. Windows system). The following two methods are provided to create replication volumes.

- (1) Creating replication volumes within the same disk array (DDR: DynamicDataReplication)
- (2) Creating replication volumes in different disk arrays (RDR: RemoteDataReplication)

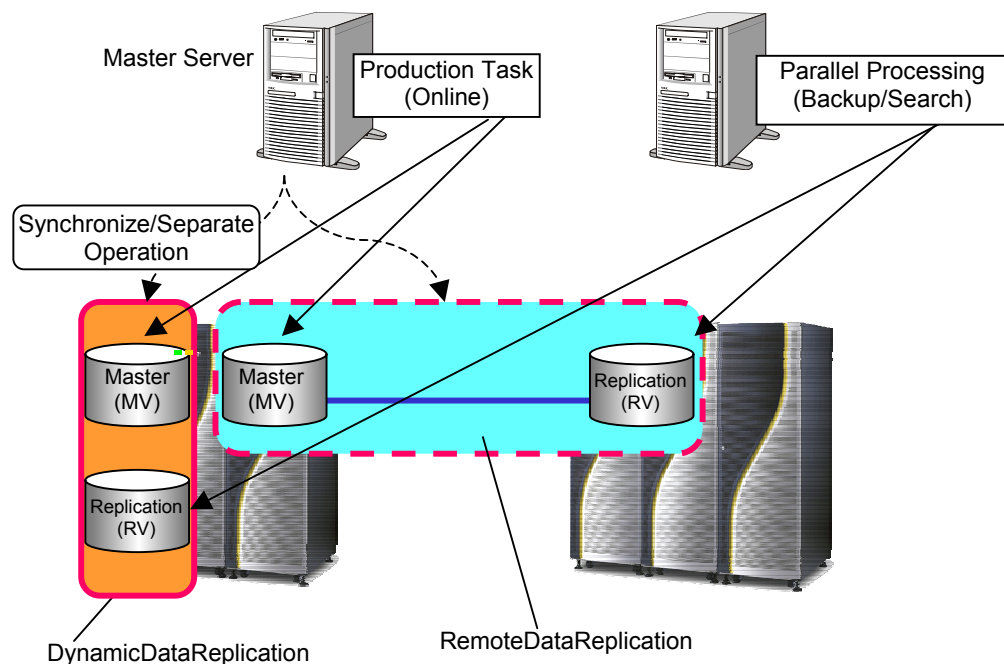


Figure 1-1 Data Replication

1.2 Examples of Applying Data Replication

When you introduce Data Replication and use replication volumes which can be separated, you can get the following benefits.

- The system down time during data backup is largely reduced. Lowered access performance to the business database during data backup in system operation can be prevented.
- A test environment using the actual business data can be built more easily.
- Processing becomes more efficient due to parallel processing of data update tasks and data reference tasks.

In this way, Data Replication makes system construction and system management easier and more effective.

The following sections illustrate some applications of Data Replication.

1.2.1 Backup

This section describes an application for backup using replication volumes.

[Backing Up from the Replication Volume to Magnetic Tape Media]

In this method, a replication volume of the master volume is backed up to the magnetic tape.

In this case, operations are suspended only for the time it takes to separate replication volumes from the master volume. Therefore, the suspension time can be substantially reduced.

Because backup is done from the replication volume, it does not affect the master volume.

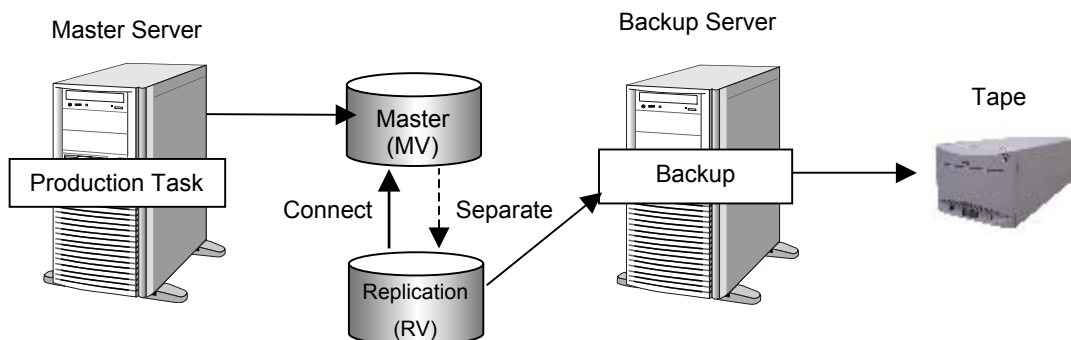


Figure 1-2 Backup from Replication Volume

The procedure for backup from a replication volume is described below.

- (1) During operation, the master volume (MV) and replication volume (RV) are connected.
- (2) Suspend the production task and separate the replication volume (RV). Resume the task after separation is complete.
- (3) Use the separated replication volume (RV) to perform backup and the task in parallel. After backup is complete, reconnect the replication volume (RV) (Reconnection takes only a short time because only updated parts in the master volume are reflected to the replication volume (RV)).

[Using the Replication Volume as Disk Backup]

In this method, the replication volume is used as backup of the master volume. In this case, you do not have to manage the existing magnetic tapes because they are not used as storage media.

When the restoration instruction is complete, you can use the backup data even if the actual data replication has not been completed. If data to be accessed is not restored to the master volume, the data in the replication volume is accessed. The user does not have to be aware of using which of the master volume or replication volume.

This reduces the data restoration time substantially.

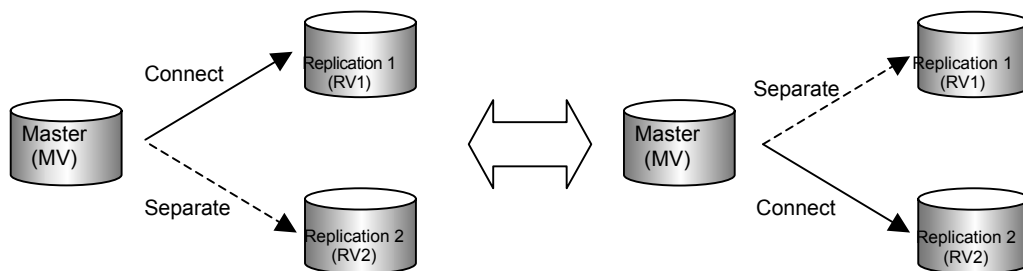


Figure 1-3 Using Replication Volume as Backup

The procedure for using a replication volume for backup is described below.

- (1) Connect the replication volume 1 (RV1) to the master volume.
- (2) Suspend the production task and separate the replication volume 1 (RV1). Resume the task after connecting the replication volume 2 (RV2).
- (3) After that, use the replication volume 1 (RV1) and replication volume 2 (RV2) alternately to perform backup.

1.2.2 Test Environment Setting

You can set the same environment as the production task environment easily by creating replication volumes using the Data Replication function. You can evaluate an application program by using data used in the production task, which makes evaluation of application programs more efficient.

Furthermore, in building an evaluation environment, operations are suspended only for the time which takes to separate replication volumes from the master volume. Therefore, the suspension time can be substantially reduced.

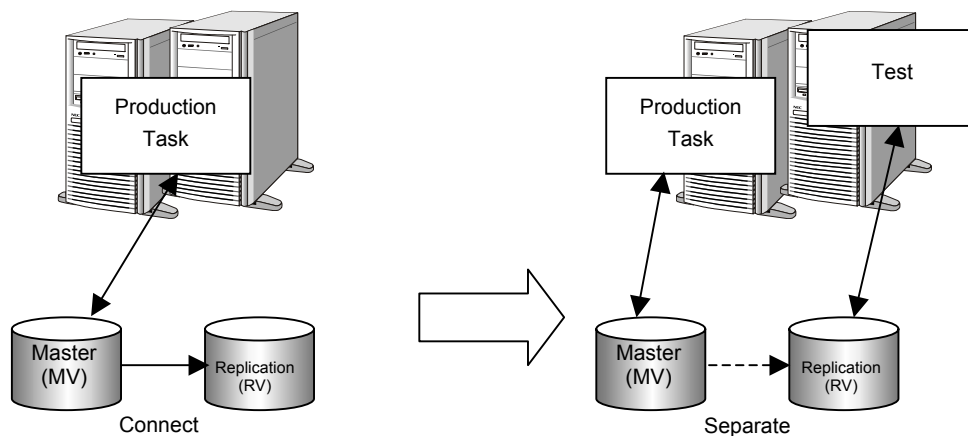


Figure 1-4 Test Environment Setting

The procedure for using a replication volume as a test environment is described below.

- (1) Connect the master volume (MV) and replication volume (RV).
- (2) Suspend the production task, separate the replication volume (RV), and then resume the task.
- (3) Perform evaluation of the application program by using the separated replication volume (RV).

1.2.3 Parallel Processing of Search Operation

By creating replication volumes of the master database, you can separate the database and carry out update tasks and search tasks using different volumes. This allows you to carry out database update tasks without affecting database search tasks.

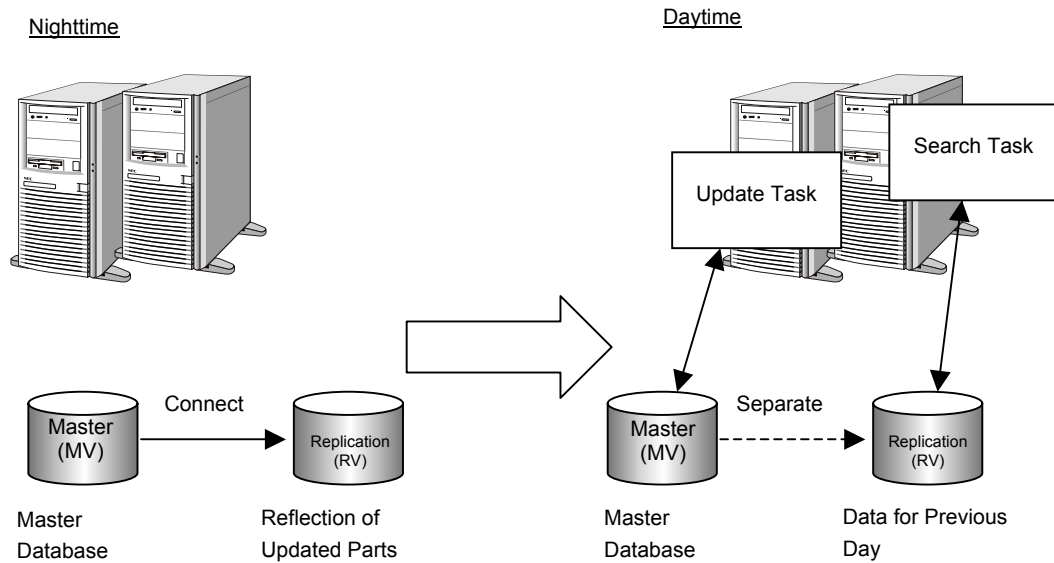


Figure 1-5 Parallel Processing of Search Task

The procedure for parallel processing of search operation is described below.

- (1) In the nighttime, suspend search tasks and connect the master volume (MV) and replication volume (RV).
- (2) In the daytime, separate the master volume (MV) and replication volume (RV). Then perform update tasks and search tasks in parallel (RV contains data for the prior day).

1.3 System Configuration

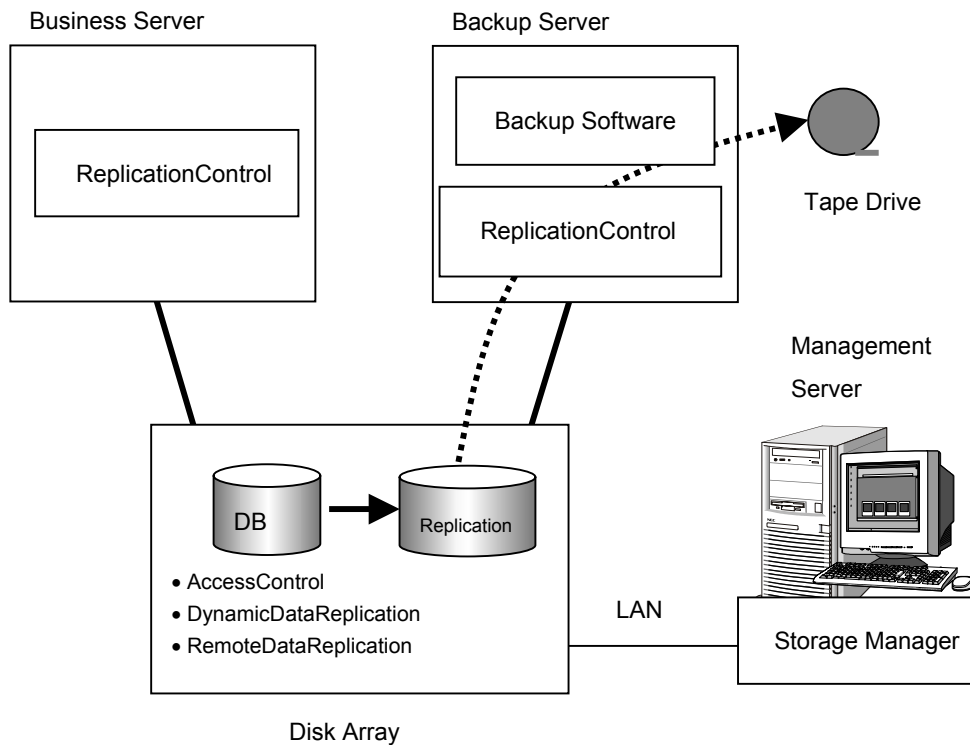


Figure 1-6 System Configuration

To install and use the Data Replication function, the following hardware devices are required.

- Disk array
Disk arrays on which the Data Replication function either with DynamicDataReplication or RemoteDataReplication is installed are required.
- Management server
iSM is installed in the management server that monitors disk arrays. This server controls disk arrays and the Data Replication function.
- Business server/backup server
Performs Data Replication operation or backup operation in cooperation with business.

Software to run Data Replication consists of the following components.

- Storage Manager

Provides the disk array configuration and state display functions.

Installing DynamicDataReplication and/or RemoteDataReplication allows the replication management function (hereinafter, referred to as the Replication Management) incorporated in iSM.

The Replication Management provides setting and operating functions such as state display, pair setting, and replication operation for DynamicDataReplication or RemoteDataReplication.

- ReplicationControl

Provides commands for checking replication operations and replication states from the business server and also provides library functions.

- AccessControl

The function to set the logical disks that can be accessed, for each business server.

- DynamicDataReplication

The function to realize data replication within the same disk array.

- RemoteDataReplication

The function to realize data replication in the different disk arrays.

Chapter 2 Data Replication

This chapter describes the types and state transitions of volumes that are necessary to perform operation using the Data Replication function.

2.1 Volume Classification

To create replication volumes using the Data Replication function, you must set the relation between the original volume and the target volume (replication volume) first. In replication control, the original volume is called MV (Master Volume), and replication volume is called RV (Replication Volume). Furthermore, MV and RV are set as a pair.

In a disk array to which the Data Replication function is installed, the volume classification in the disk array is categorized into the following three types. Figure 2-1 describes sample volume classification.

- Isolated Volume (IV)

Volume with no pair setting.

By specifying the pair setting to IV, you can set it to MV or RV.

- Master Volume (MV)

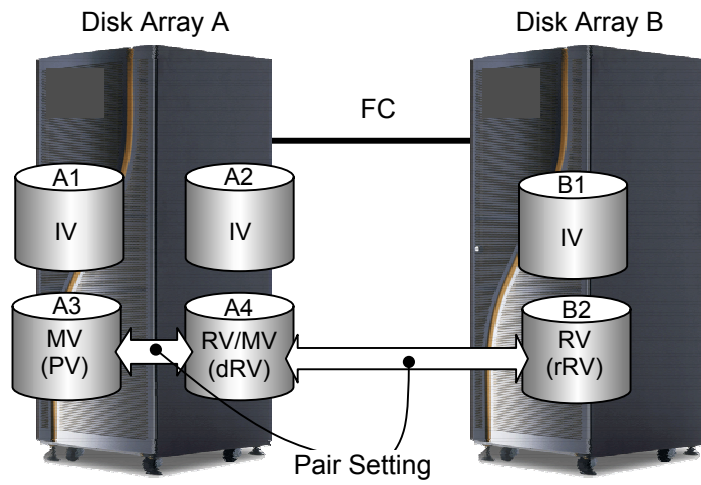
Volume with the pair setting. The original volume in the pair. Normally, volumes used in operation are set as MVs.

To distinguish the uppermost MV from other MVs when multiple pairs are set in series hierarchically, it is called the Primary Volume (PV).

- Replication Volume (RV)

Volume with the pair setting. The target volume in the pair. Normally, volumes used as backup or in test operation are set as RVs.

The pair setting can be between the volumes within the same disk array, or between the volumes in different disk arrays. To distinguish them, the former is called a Dynamic Replication Volume (dRV) and the latter is called a Remote Replication Volume (rRV).



Volume	A1/A2/B1	: IV
Volume	A3	: MV (PV) of the pair A3/A4
Volume	A4	: RV (dRV) of the pair A3/A4, and MV of the pair A4/B2
Volume	B2	: RV (rRV) of the pair A4/B2

Figure 2-1 Example of Volume Classification

2.2 Replication Operations

The replication operations include Replicate that replicates data from MV to RV, Separate that separates between MV and RV, and Restore that replicates data from RV to MV.

2.2.1 Replicate

This operation copies data from MV to RV.

It is performed to replicate the latest data to the replication volume used in a test environment or search tasks. When Replicate is executed, the data in MV is copied to RV. In addition, any update made to MV after Replicate is reflected to RV.

2.2.2 Separate

This operation separates MV and RV.

It is performed to suspend data replication between MV and RV to use RV in a test environment or search tasks.

When Separate is started, all the difference between the MV and RV contents at the point of starting Separate is reflected into the RV, and then data replication is suspended and the RV is separated. The updates made to MV after starting Separate are not reflected to RV and stored in the disk array as update differences.

When executing Separate, you can determine when to make the RV available by choosing either of the following:

- Separate for making RV available after completion of separation: `Separate(completion)`
Reflects all the difference between the MV and RV contents into the RV, and makes the RV available after completion of separation.
Even though Separate is executed immediately after Replicate starts, RV cannot be used while the difference between MV and RV is being reflected to RV. RV becomes available upon completion of separation.
- Separate for immediately making RV available: `Separate(immediate)`
While reflecting the difference between the MV and RV contents into the RV, the Separate function makes the RV available even during separation. You can instantly create RV and make it available by executing `Separate(immediate)`.
This function is available only for performing data replication in the same disk array. The product “DynamicDataReplication Ver2” is necessary for using the function.

2.2.3 Restore

This operation copies data from RV to MV.

It is performed to restore data from the backup volume (RV) when a failure occurs in MV.

When Restore is executed, the RV contents at the point of starting Restore are reflected copied into the MV. At this time, you can determine whether to reflect the updated data of the MV into the RV by choosing either of the following:

- Restore with RV being updated: Restore(update)

Restores the MV while automatically reflecting the updated data of the MV into the RV. Even after the difference between MV and RV is resolved and Restore is completed, any data update made to MV is reflected to RV.

- Restore without RV being updated: Restore(protect)

Restores the MV without reflecting the updated data of the MV into the RV. After the difference between MV and RV is resolved and Restore is completed, Separate is automatically executed. The Restore(protect) function enables you to save the RV data in the state before the restoration.

The product DynamicDataReplication Ver2 or RemoteDataReplication Ver2 is necessary for using the function.

2.3 Replication Operations and State Transitions

This section describes the replication operations and state transitions.

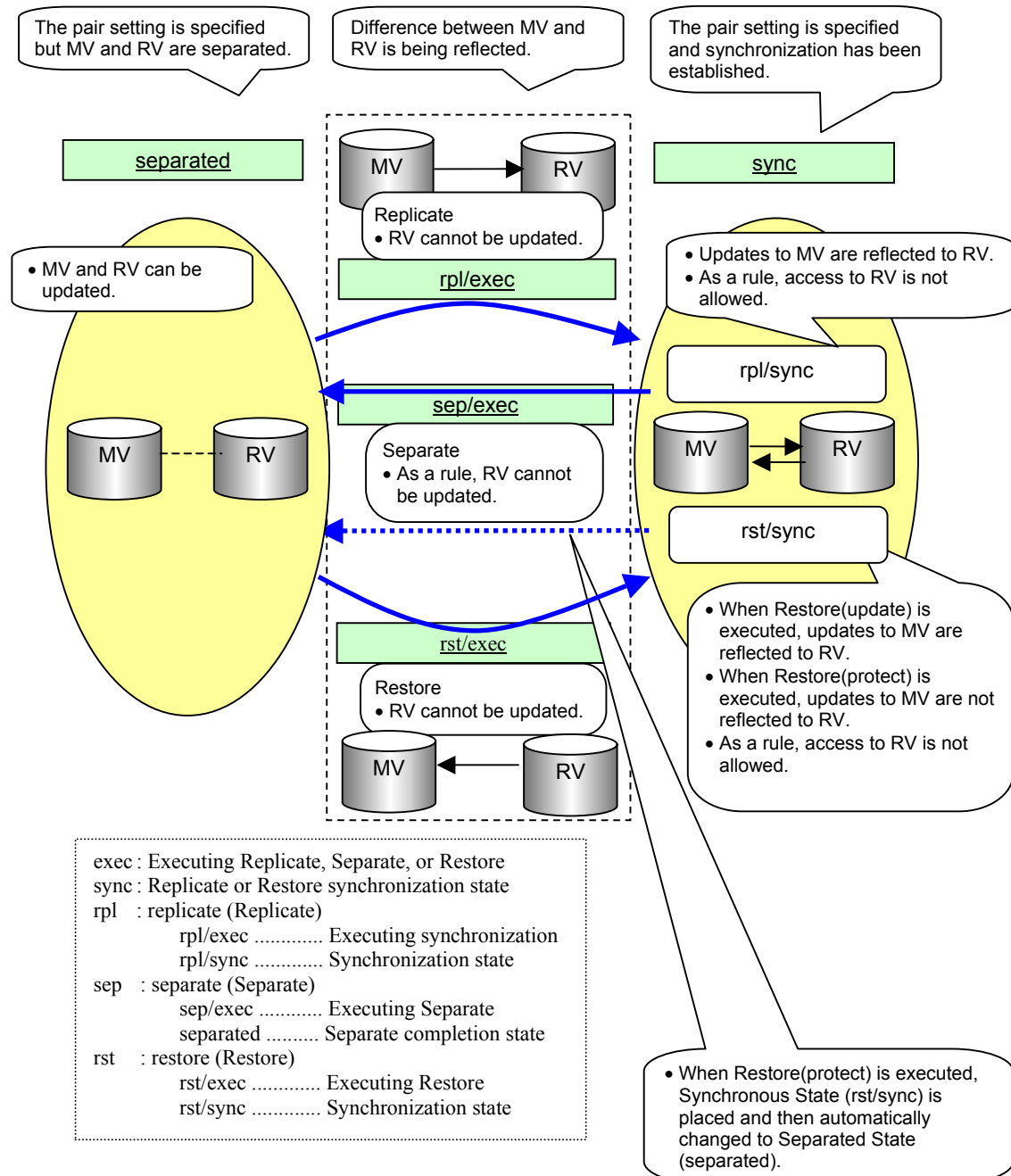


Figure 2-2 Replication Operations and State Transitions

2.3.1 Replicate and State Transitions

When Replicate is performed, data copy from MV to RV starts to reflect the content of MV to RV.

Any update to MV after Replicate is also reflected to RV.

After Replicate is started, the difference between MV and RV gradually decreases, and eventually the content of MV at the beginning of Replicate is completely reflected to RV (The difference is zero).

The state from the beginning of Replicate to the content of MV is completely reflected to RV is called the “Replicate execution”. The state where the difference between MV and RV is zero is called the state synchronized by Replicate, or simply the “synchronous state”. Replicate execution and the state synchronized by Replicate are collectively called the Replicate state.

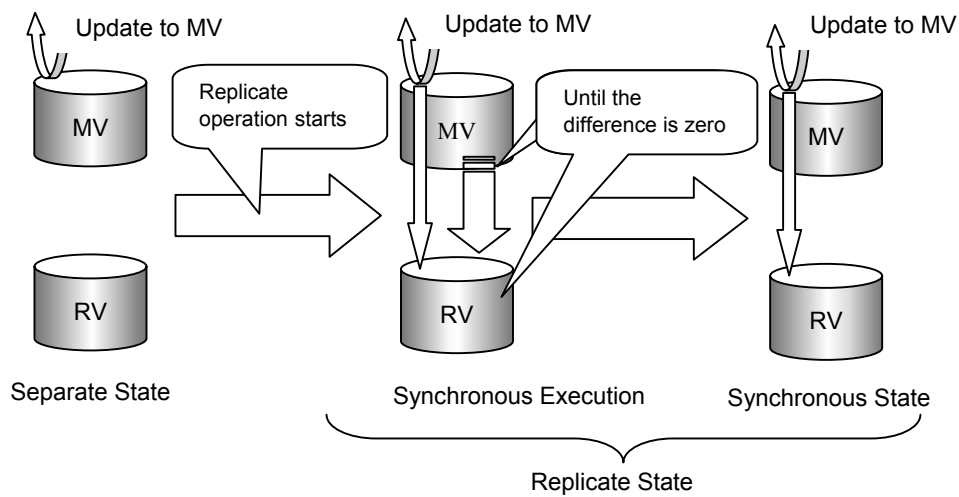


Figure 2-3 Replicate and State Transitions

2.3.2 Separate and State Transitions

When Separate is performed, the difference between MV and RV at the time of executing the Separate start instruction is reflected to RV and RV is separated. No update to MV after Separate is reflected to RV.

After Separate is performed, data copy to RV is performed if the contents of MV and RV at the beginning of Separate do not match, and all updates to MV before the Separate start instruction are reflected to RV. The state from the beginning of Separate to the content of MV at the beginning of Separate is completely reflected to RV is called the “Separate execution state“. The state where all updates to MV are reflected to RV is called the state separated by Separate, or the “separated state“. Separate execution and the separated state are collectively called the Separate state.

When Separate is executed under specification of immediate use of RV (Separate(immediate)), the RV contents can be referred to or updated immediately after the Separate start instruction is issued, regardless of whether or not all the MV contents have been reflected into the RV. This feature is implemented as follows.

When an update/reference request for the RV is made and access to an area where difference copy from the MV into RV is not completed is to be made, control is performed for copying the difference from the MV into RV before permitting access to the area.

The updates made to MV until Separate is started are reflected to RV. The updates made to MV after Separate is started are not reflected to RV and managed as update difference.

The updated states of MV and RV are managed in Separate State so that the difference between the MV and RV contents is reflected when Replicate/Restore is executed.

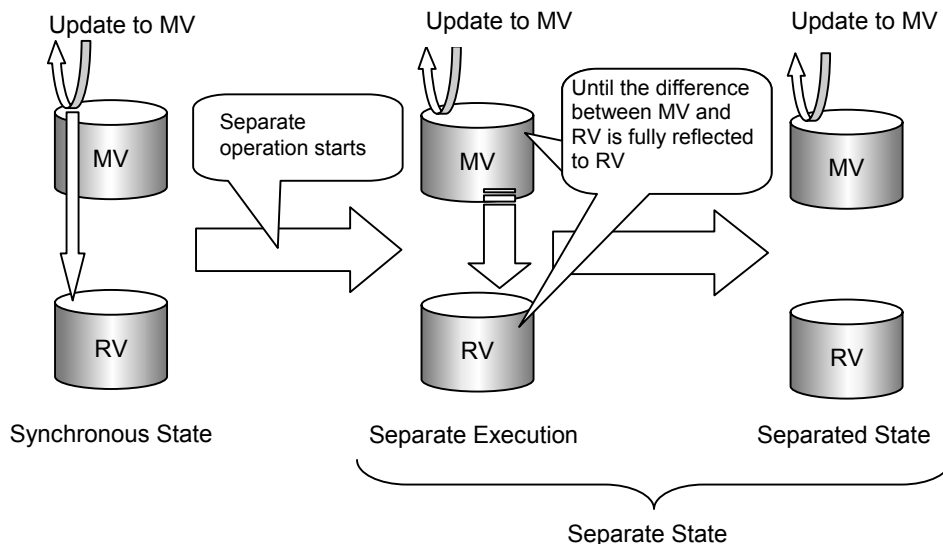


Figure 2-4 Separate and State Transitions

2.3.3 Restore and State Transitions

When Restore is performed, data copy from RV to MV starts to reflect the content of RV at the beginning of Restore to MV. When Restore(update) is executed, any update to MV after Restore is also reflected to RV.

After Restore is started, the difference between MV and RV gradually decreases, and eventually the content of RV at the beginning of Restore is completely reflected to MV (The difference is zero). The state from the beginning of Restore to the content of RV at the beginning of Restore is completely reflected to MV is called the “Restore execution”. The state where the difference between MV and RV is zero is called the state synchronized by Restore, or simply the “synchronous state”. Restore execution and the state synchronized by Restore are collectively called the Restore state.

When Restore(protect) is executed, the updated data of the MV is not reflected into the RV. In this case, the updated information of the MV is managed as the difference between the MV and RV contents so that the difference can be reflected into the RV when Replicate/Restore is executed subsequently. When the Synchronous State (sync) is placed after Restore(protect) is executed, it is automatically changed to the Separated State (separated).

When data of MV is referred to during Restore execution, the user can refer to the content of RV immediately after the instruction to start Restore even if the content of RV has not been completely reflected to MV. This is done by obtaining data from RV when the area where difference copy from RV to MV has not been completed is accessed in response to a reference request to MV.

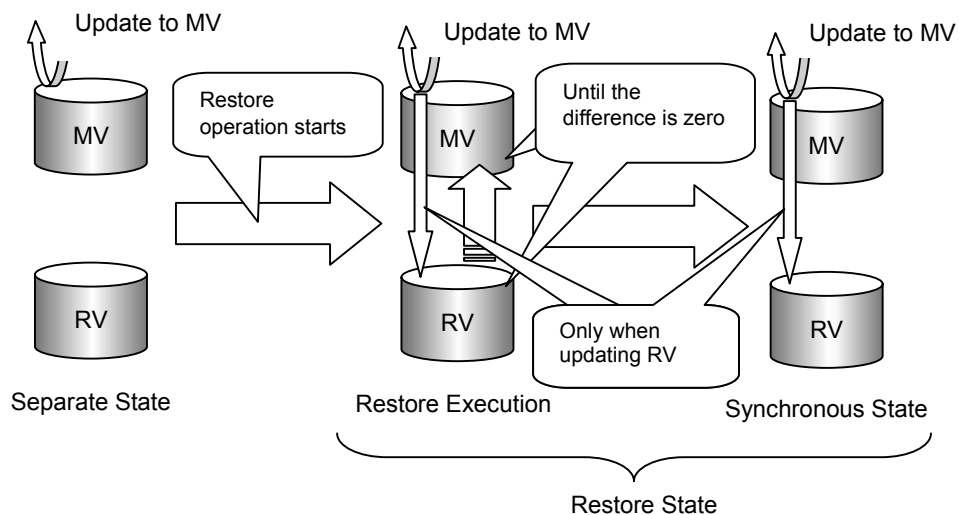


Figure 2-5 Restore and State Transitions

2.3.4 Activity State and Synchronous State

In data replication, Replicate, Restore, and Separate states are called “activity states”, or simply “activities”.

The execution states indicating state transitions and the state in which the state transition is complete are called “synchronous states”.

Table 2-1 shows the activity states and synchronous states which transit as a result of each replication operation. For information on handling MV and RV access in the activity states, refer to 2.6 “RV Access Restriction”.

Table 2-1 Activity State and Synchronous State

Activity State	Synchronous State	Description
Separate State	Separate Execution (sep/exec)	<ul style="list-style-type: none"> Temporal state until the difference between MV and RV becomes zero after Separate As a rule, read and write to RV are not allowed.
	Separated(separated)	<ul style="list-style-type: none"> Data copy between MV and RV is not performed. This state occurs immediately after the pair setting. Normally, read and write to RV are allowed.
	Forced Separate(cancel)	<ul style="list-style-type: none"> MV and RV are forcibly separated by Forced Separate. Read and write to RV are allowed.
	Failure Separation (fault)	<ul style="list-style-type: none"> MV and RV are forcibly separated in the disk array due to a copy fault. Read and write to RV are allowed.
Replicate State	Synchronous Execution (rpl/exec)	<ul style="list-style-type: none"> Reflection of the difference between MV and RV at Replicate has not been completed (The difference is being reflected from MV to RV). Updates to MV is reflected to RV. As a rule, read and write to RV are not allowed.
	Synchronous State(rpl/sync)	<ul style="list-style-type: none"> Reflection of the difference between MV and RV at Replicate has been completed. Updates to MV is reflected to RV. As a rule, read and write to RV are not allowed.
Restore State	Restore Execution(rst/exec)	<ul style="list-style-type: none"> Reflection of the difference between MV and RV at Restore has not been completed (The difference is being reflected from RV to MV). When Restore(update) is executed, the updated data of the MV is reflected into the RV. When Restore(protect) is executed, the updated data of the MV is not reflected into the RV. As a rule, read and write to RV are not allowed.
	Synchronous State(rst/sync)	<ul style="list-style-type: none"> Reflection of the difference between MV and RV at Restore has been completed. When Restore(update) is executed, the updated data of the MV is reflected into the RV. When Restore(protect) is executed, the updated data of the MV is not reflected into the RV and the Separate completion state is automatically entered. As a rule, read and write to RV are not allowed.

2.4 Copy Control State

If the activity between volumes with the pair setting is the Replicate or Restore state, you can change the copy method of data between MV and RV according to the load status of the disk array. The state to which a transition is made by the instruction to change the copy method is called the “copy control state”. There are the following two types of copy between MV and RV in the Replicate or Restore state.

- Copy for reflecting difference
Copy to reflect the content of MV (RV for Restore) at Replicate or Restore to RV (MV for Restore).
- Copy to reflect updates in MV to RV
Copy to reflect updates in MV to RV after Replicate or Restore. However, if Restore(protect) is executed, the updated data of the MV is not reflected into the RV.

You can change the copy method and state by changing the copy control state.

There are the following copy states in the copy control states as shown in Table 2-2.

Table 2-2 Copy Control State

Copy Control State		Copy State
Foreground Copy	Synchronous Copy Mode	<ul style="list-style-type: none"> • Copy for reflecting difference is performed. • Updates to MV are reflected RV sequentially.
	Semi-synchronous Copy Mode	<ul style="list-style-type: none"> • Copy for reflecting difference is performed. • I/O of updates to MV is completed when data is written to MV, and the data is copied to RV immediately after that. • Can be set for a RemoteDataReplication pair.
Background Copy	-	<ul style="list-style-type: none"> • Copy for reflecting difference is performed. • I/O of updates to MV is completed when data is written to MV, and the data is accumulated as difference information. For the accumulated difference, data is copied to RV asynchronously. The copy interval to RV (Background Copy Level) can be changed in units of disk arrays.
Suspend	Suspend	<ul style="list-style-type: none"> • Copy for reflecting difference is not performed. • I/O of updates to MV is completed when data is written to MV, and the data is accumulated as difference information. Reflection to RV is not performed.
	Suspend due to a failure	<ul style="list-style-type: none"> • Forcefully suspended in the disk array due to a copy fault. • Copy for reflecting difference is not performed. • I/O of updates to MV is completed when data is written to MV, and the data is accumulated as difference information. Reflection to RV is not performed.

Copy control states can be specified when Replicate or Restore is performed. You can also change the copy control state you specified at Replicate or Restore as required.

When Restore with RV protection specified is executed, only copy for reflecting the difference is executed, thus the updated data of the MV is not reflected into the RV. Therefore, specifying or changing a copy control state (Synchronous Copy Mode, Semi-synchronous Copy Mode, or Background Copy) has no effect.

There are the following five instructions to change the copy control state.

- Synchronous Copy instruction
- Semi-synchronous Copy instruction
- Resume instruction
- Background Copy instruction
- Suspend instruction

The Resume instruction changes Background Copy or Suspend to preceding Foreground Copy (Synchronous Copy Mode, Semi-synchronous Copy Mode).

Figure 2-6 shows the state transition diagram of the copy control states.

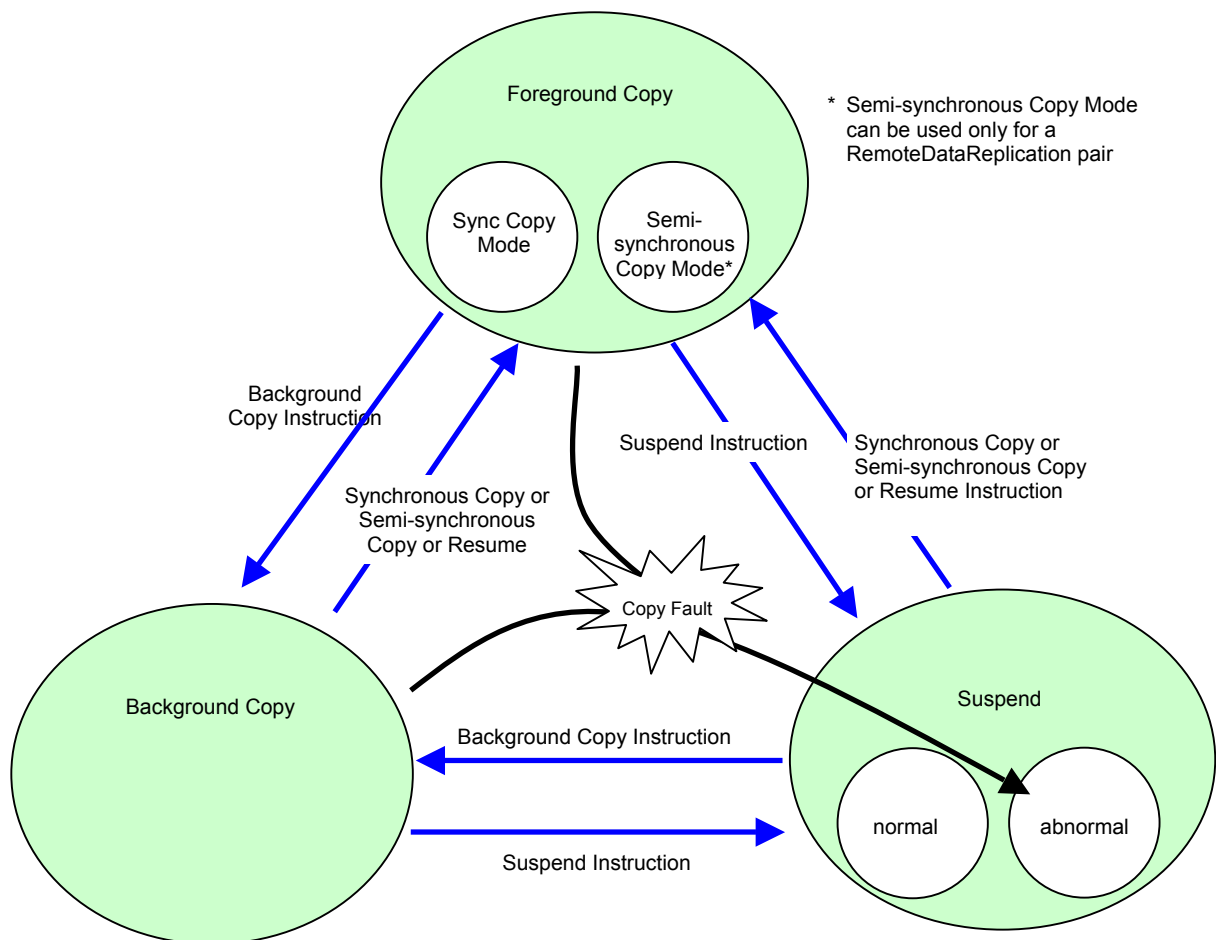




Figure 2-6 State Transition Diagram of Copy Control State

2.5 Relationship between Copy Performance and Copy Control State

If the copy control state is set to the Synchronized Copy state, the difference between MV and RV is not accumulated because updates to MV are immediately reflected to RV. However, the write time to MV is longer because it waits for reflection of the updates to RV. If the Copy Control state is set to the Suspend state, the difference between MV and RV is accumulated because updates to MV are not reflected to RV, but the write time to MV is the same as normal I/O.

In this way, there are correlations between the amount of accumulated differences in MV and RV and write performance in different copy control states. The correlation for each copy control state is shown in Table 2-3.

Table 2-3 Correlations in Different Copy Control States

Copy Control State	Difference between MV and RV	Write Overhead to MV
Foreground (Synchronous)	Small	Exists
Foreground (Semi-synchronous)		
Background		
Suspend		
	Large	Does not exist

If the difference between MV and RV is large in the Replicate state, we recommend to select a copy control state which gives the difference between MV and RV smaller in a system without sufficient suspension time for Separate execution because the processing time of Separate increases. Also, we recommend you to select a copy control state without write overhead to MV in a system where write performance to MV must be maintained and improved.

2.6 RV Access Restriction

In the Replicate state and Restore state, MV is synchronized with RV to always match the volume data between MV and RV. Since the difference between MV and RV is reflected in the disk array independently of the operating system or file system, however, the volume of RV may become inconsistent. Therefore, the data replication function cannot impose access restrictions for MV, and MV can be referred to and updated at any time. The function can impose access restrictions for RV for activity state to prevent malfunction.

Table 2-4 shows the states which can be specified as RV access restrictions.

Table 2-4 RV Access Restriction

Access Restriction	Description	Activity State			
		rpl	rst	sep/exec	separated
Read/Write (R/W)	RV is enabled for read/write.	-	-	Δ Note 1	○
Read Only (RO)	RV is enabled only for reading.	Δ Note 2	Δ Note 2	Δ Note 2	Δ Note 3
Not Ready (NR)	RV is disabled for read/write.	○	○	○	-
Not Available (NA)	RV is not recognized by the operating system or the LU (Logical Unit) is invalid.	Δ Note 4	Δ Note 4	Δ Note 4	Δ Note 4

○: Available

Δ: Available with administrative restrictions

-: Unavailable

rpl: Replicate state

RW: Read/Write

rst: Restore state

RO: Read Only

sep/exec: Separate execution

NR: Not Ready

separated: Separated state

NA: Not Available

Note 1: For Separate(immediate), “Read/Write (RW)” is set even during execution of Separate.

However, keep the following operational influence in mind:

1. Data is being copied from the MV into RV during Separate execution. Therefore, if the I/O load on the RV is high, I/O performance on the MV side may lower.

Note 2: You can set “Read Only (RO)” to RV in the Replicate state, Restore state, or Separate execution. In this case, note the following.

1. No update to MV should be done when RV is referred to in the Replicate state or Restore state.
2. For updates to MV, I/O processing is done to the disk by the operating system control of the file system. Even if the application has completed the update process to the disk, it has not necessarily completed the update process to MV. Reflection of the update to RV is processed in the disk array independent of the operating system.
Therefore, RV cannot be referred to normally because it is not consistent as a volume.
You can use it if consistency is assured in the specific operation.

Note 3: If “Read Only (RO)” is set for RV for which Separate was completed, keep the following operational notes in mind.

<On the Windows system>

1. If NTFS is used as a file system, reference to the RV is disabled.
2. If FAT16/FAT32 is used as a file system, associate the file system with the drive by using the mount command of the disk control operation commands or by starting [Disk Management] (Windows).
3. If FAT16/FAT32 is used as a file system, an attempt to write to RV ends up with an error. Therefore, do not use any application for automatically performing write operation for the drive. Do not perform any operation (e.g., changing of a partition configuration) in which write to RV is performed through [Disk Management] (Windows).

<On the UNIX system>

When mounting a file system, it is necessary to mount it by a read-only specification.

Note 4: The “Not Available (NA)” state has meaning when the VSS (Volume Shadow copy Service) function is used. A transition to the Not Available state is automatically controlled by the VSS function. The user need not perform the operation normally.

2.7 Copy Faults and State Transitions

If copy operation between MV and RV is not performed normally due to a connection failure between them, a transition to the following states may occur depending on the timing and type of the failure.

- Separate state due to a fault (failure separation)

Forcefully separated in the disk array due to a copy fault. The contents of MV and RV are completely different.

To cancel the Separate state due to a failure, remove the cause of the copy fault and perform restoration by using Replicate and Restore.

- Suspend state due to a fault (abnormal suspend)

Forcefully suspended in the disk array due to a copy fault in the Replicate or Restore state. Copy between MV and RV is suspended.

To cancel the Suspend state due to a failure, change the copy control state as you do to cancel the normal Suspend state after removing the cause of the copy fault (Refer to 2.4 “Copy Control State”).

2.8 Freeze of Disk Arrays

If the power to the disk array is turned off for maintenance, access to the disk array is disabled, disallowing to continue copy operation for the paired volumes in the disk array. In this situation, the data replication function for the disk array stops replication operations of the whole disk array.

Freezing of replication operations for the disk array due to power down of the disk array is called freezing of the disk array and the state is called the freeze state of the disk array.

When a disk array is in the freeze state, replication operations between volumes to which the pair setting with the volume in the disk array is specified are also suspended, and the copy control state of the pair becomes the freeze state.

When the pair is in the freeze state, no new replication operation can be performed.

For pairs in the freeze state, note the following.

- Freeze in the Separate state

If the pair goes into the freeze state in Separate execution, it transits to the Separate state due to a fault (failure separation) when the following operation is performed.

<When updates to MV are done to the area where copy to RV has not been completed>

In this case, to use RV after the freeze state is cancelled, you must perform Replicate again to copy data, and perform Separate.

- Freeze in the Replicate state

If the pair goes into the freeze state in the Replicate state, copy operation between MV and RV is suspended. Copy operation is automatically resumed when the freeze state is cancelled.

- Freeze in the Restore state

If the pair goes into the freeze state in the Restore state, I/O terminates abnormally when reference or update is performed to the area where copy from RV to MV has not been completed.

If the pair goes into the freeze state in the restored state, copy operation between MV and RV is suspended.

Copy operation is automatically resumed when the freeze state is cancelled.

Chapter 3 Replication Management

This chapter describes various operations of Data Replication by the Graphical User Interface (GUI).

3.1 Replication Management Overview

This chapter describes an overview of various operations and the management method regarding data replication that uses the replication management function.

3.1.1 Operations and Authorization Levels

Use the following functions to perform operations related to Data Replication through the iSM Client:

- State Monitoring
- Replication manager
- Configuration setting

Since operations performed from Replication manager includes important operations on volumes, the operating authorization is set according to the following allowance levels.

However, when the server is disconnected by State Monitoring after displaying the Replication screen, only the currently displayed state (the information gained while the server was connected) can be referenced regardless of the operation authorization.

- L1: Allows only reference.
- L2: Allows replication-related operations (copy operations) in the administration level.
- L3: Allows all operations.

For information on how to set and log in, refer to the “User’s Manual” or “User’s Manual (UNIX)” in accordance with your OS.

Table 3-1 lists the operations and state displays.

Table 3-1 List of Displays/Operations of Data Replication

Operation Item	State Monitoring	Configuration Setting	Replication Management			
			Display	Operation Authorization		
				L1	L2	L3
Set Disk Array Name	√	√	√	-	-	-
Set Logical Disk Name	√	√	√	-	-	-
Link State	-	-	√	-	-	-
Pair Setting/Unpair	-	-	√	-	-	√
Replicate	-	-	√	-	√	√
Separate	-	-	√	-	√	√
Restore	-	-	√	-	√	√
Suspend/Resume Copy	-	-	√	-	√	√
Change to Background Copy	-	-	√	-	√	√
RV Mode Change	-	-	√	-	√	√
Forced Separate	-	-	√	-	√	√
Forced Unpair	-	-	√	-	-	√
Freeze/Defreeze	-	-	√	-	-	√
Background Copy Level Change	-	-	√	-	-	√
Pair Batch Setting	-	√	-	-	-	-

√: Available -: Not available

L1: Allows only reference.

L2: Allows replication-related operations (copy operations) in the administration level.

L3: Allows all operations.

3.1.2 Event Detection and Operation Message Output

Events that occur in response to various operations performed on disk arrays and volumes can be detected by the state monitoring and displayed in the iSM Client's message display area as operation messages.

By executing an environment setting beforehand, it is possible to detect events that occur as the result of executing replication operation commands or other operations as well as performing replication management operations, and it is also possible to confirm the events from operation messages.

Table 3-2 shows the replication-related events that can be confirmed as operation messages:

Table 3-2 List of Replication-Related Events

Operation Target	Operation	Replication Management Operation	Other Operations
Disk array	Freeze	○	△
	Defreeze	○	△
	Change Background Copy level	○	△
Volume	Pair Setting/Unpair	○	△
	Replicate	○	△
	Synchronous State (rpl/sync)	△	△
	Separate	○	△
	Separated	△	△
	Restore	○	△
	Synchronous State (rst/sync)	△	△
	Suspend/Resume Copy	○	△
	Change to Background Copy	○	△
	Change RV Mode	○	△
	Change Copy Mode	○	△

○: Regular report △: Additional report performed according to an environment setting -: Not reported

Note: Replication management operations include operations performed together with the ReplicationControl commands.

Regarding S2100 and A2100, the detection of events other than pair setting and unpairing events may not be possible during the state monitoring.

Furthermore, the state monitoring monitors all the disk arrays' volumes for a specified time interval (default: 15 seconds) to detect events. Therefore, there is a time difference between when an event actually occurred and when a message is output. Also, messages for each detected event are displayed at the same time.

For information about an environment setting regarding the state monitoring's event detection time interval and operation message output control, refer to the "User's Manual" or "User's Manual (UNIX)" in accordance with your OS.

3.1.3 Notes on Operation

Note the following points when operating replication management:

[System Parameter Setting (on UNIX)]

For more information, refer to the “User’s Manual (UNIX)”.

[Messages at Start]

Immediately after iSM is started, replication-related device information is created internally.

Replication-related device information is recreated according to an information recreate instruction from ReplicationControl.

Even if an attempt is made to display the Replication Screen at this timing, the screen cannot be displayed because the device information cannot be obtained. If this happens, retry to display the screen after a while.

[Action to Be Taken at Occurrence of Problems]

Refer to dialogs (messages) or help to take appropriate action.

3.2 Explanation of Replication Screen

To perform an operation, select the volumes you want to perform the operation to in the Volume List Displayed on the Replication Information tab in the Replication Screen, and then click the [menu] on the menu bar. You can also right-click the volume to display the menu.

3.2.1 Replication Screen

The Replication Screen consists of the configuration display area (i) on the left part of the screen displaying the configuration and state of the disk array and the information list display area (ii) on the right part of the screen displaying the Volume List and disk array link configuration. When the Replication Screen appears for the first time, it contains only the configuration display area (i) and the information list display area (ii) is displayed by clicking the disk array icon. The information list display area (ii) shows the selected disk array and the Volume List of the disk array connected with the selected disk array by RemoteDataReplication.

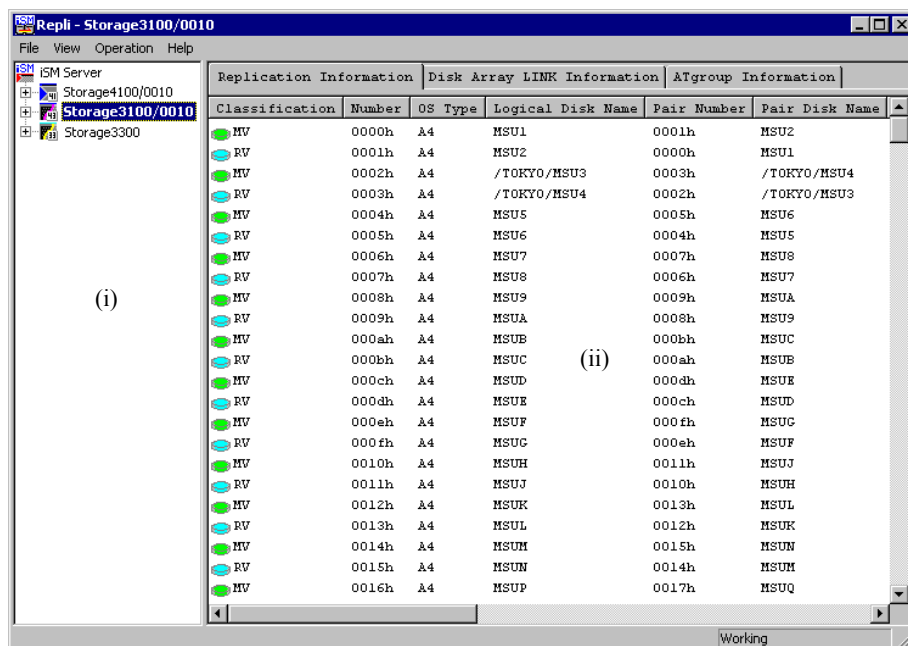


Figure 3-1 Example of Replication Screen

- (i) For details, refer to 3.2.2 “Configuration Display Area”.
- (ii) For details, refer to 3.2.3 “Replication Information Screen” and 3.2.4 “Disk Array LINK Information Screen”.

* For details on the AT-group information screen, refer to the “Data Replication User’s Manual (Disaster Recovery System Installation and Operation Guide)”.

3.2.2 Configuration Display Area

The configuration display area is under the monitoring by the iSM and displays the list and the state of the Disk Arrays that can use the Replication function, as well as the status of link among them.

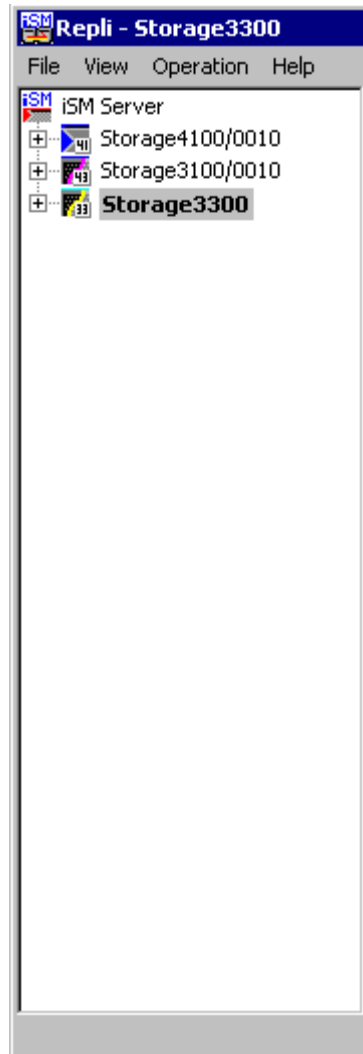
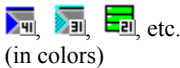








Figure 3-2 Example of Configuration Display Area

Disk Array icon

Icon	Description
 etc. (in colors)	Indicates that the disk array is normally operating.
	Indicates that the license capacity of the DynamicDataReplication, RemoteDataReplication, or RemoteDataReplication/DisasterRecovery is insufficient. * If license capacity is insufficient, you cannot execute pair setting/unpair.
	Indicates that the fault occurs in any link path between disk arrays.
	Indicates that the copy fault or the fault in all link paths between disk arrays occurs.
	Indicates that the data replication function is frozen.
 (dark gray)	Indicates that the disk array to be linked is not directly monitored by Replication manager when a link is established between disk arrays.
 etc. (light gray)	Indicates that the state monitoring is stopped.

A disk array on which neither the DynamicDataReplication nor the RemoteDataReplication is installed does not appear on the screen.



If the Replication does not recognize the disk array of the link destination when the link is established between disk arrays, the disk array name may be displayed as the address value (Subsystem Absolute Address), which can uniquely identify the disk array not duplicated with other disk arrays.

Each information screen to be explained in the following page or later may not be displayed depending on the display items selected in the configuration display area and the state of disk array as follows.

Tabs in the information list display area cannot be selected when “iSM server” specified in the configuration display area.

[Disk Array LINK Information] tab cannot be selected when the following disk arrays specified in the configuration display area.

- Disk arrays not supporting RemoteDataReplication
- Disk arrays without RemoteDataReplication license
- Unmanaged disk arrays

[ATgroup Information] tab cannot be selected when the following disk arrays specified in the configuration display area.

- Disk arrays not supporting RemoteDataReplication and RemoteDataReplication/Disaster Recovery
- Disk arrays without RemoteDataReplication and RemoteDataReplication/Disaster Recovery

- license
- Unmanaged disk arrays

3.2.3 Replication Information Screen

When click the [Replication Information] tab in the information list display area, the volume information of the volumes in the selected disk array is displayed (refer to Figure 3-3 “Example of Replication Information Screen”).

MV and RV are displayed in one line respectively (a total of two lines) for a pair and IV is displayed in one line. If pair setting is performed for volumes, the states of the volumes are displayed in two lines for one pair so as to check the states of MV and RV. IV is displayed in one line. To perform sort, click the item name by which you want to sort. You can drag&drop an item to permute the order of the items.

When pair setting and unpairing are performed, volume information is updated according to the order of the last sort.






Replication Information			Disk Array LINK Information		ATgroup Information	
Classification	Number	OS Type	Logical Disk Name	Pair Number	Pair Disk Name	
MV	0000h	A4	MSU1	0001h	MSU2	
RV	0001h	A4	MSU2	0000h	MSU1	
MV	0002h	A4	/TOKYO/MSU3	0003h	/TOKYO/MSU4	
RV	0003h	A4	/TOKYO/MSU4	0002h	/TOKYO/MSU3	
MV	0004h	A4	MSU5	0005h	MSU6	
RV	0005h	A4	MSU6	0004h	MSU5	
MV	0006h	A4	MSU7	0007h	MSU8	
RV	0007h	A4	MSU8	0006h	MSU7	
MV	0008h	A4	MSU9	0009h	MSUA	
RV	0009h	A4	MSUA	0008h	MSU9	
MV	000ah	A4	MSUB	000bh	MSUC	
RV	000bh	A4	MSUC	000ah	MSUB	
MV	000ch	A4	MSUD	000dh	MSUE	
RV	000dh	A4	MSUE	000ch	MSUD	
MV	000eh	A4	MSUF	000fh	MSUG	
RV	000fh	A4	MSUG	000eh	MSUF	
MV	0010h	A4	MSUH	0011h	MSUJ	
RV	0011h	A4	MSUJ	0010h	MSUH	
MV	0012h	A4	MSUK	0013h	MSUL	
RV	0013h	A4	MSUL	0012h	MSUK	
MV	0014h	A4	MSUM	0015h	MSUN	
RV	0015h	A4	MSUN	0014h	MSUM	
MV	0016h	A4	MSUP	0017h	MSUQ	

Figure 3-3 Example of Replication Information Screen

The Replication Information screen displays information regarding the following items.



(i) Classification

The volume types (volume attributes) are displayed.

Displayed Icon	Description
 (Green)	MV. Indicates Master Volume which is the volume of replication origin.
 (Light Blue)	RV. Indicates Replication Volume which is the volume of replication target.
 (White)	IV. Indicates Isolated Volume and is the volume except the replication object. IV becomes MV or RV by operating pair setting.
 	Indicates the volume on which a copy fault occurs.

When the snapshot function is used, the base-volume (BV) used by snapshot is also displayed.

For snapshot, refer to the “Snapshot User’s Manual (Function Guide)”.

Displayed Icon	Description
 (Green)	MV (MV/BV) having the BV attribute. Indicates the volume of replication origin.
 (White)	IV (BV) having the BV attribute. Indicates a volume which is not a replication object. BV becomes MV (MV/BV) by operating pair setting.

(ii) Number

The logical disk number is displayed in hex digit.

It is the same as the logical disk number shown in the main screen (State Monitoring screen).


(iii) OS Type

Indicates the volume format.

When performing Replication operations, the OS type must be correctly specified.

Display	Description
A2	Indicates ACOS-2 format volume
A4	Indicates ACOS-4 format volume
AX	Indicates AIX format volume
CX	Indicates Solaris format volume
LX	Indicates Linux format volume
NX	Indicates HP-UX format volume
WN	Indicates Windows format volume

(iv) Logical Disk Name

The identification name or identifier (see Note ) given for the logical disk is displayed.

It is the same as the logical disk name displayed in the main screen (State Monitoring screen) and can be changed from the main screen (State Monitoring screen).



When the events given below have occurred when displaying the Replication Information screen, the “Logical Disk Name” or “Paired Disk Name” field may show the unique volume number (Volume Absolute Address) managed inside the disk array.

- The link failure has occurred.
- The Disk Array on the remote side is not managed by iSM or is in monitoring-stop state.

These events occur in a pair connected by RemoteDataReplication when the host to which a local volume is connected cannot recognize the volume on the remote side. Also in such a case, operations such as Forced Separate and Forced Unpair for local volumes are enabled.

(v) Pair Number

The logical disk number of paired volume is displayed in hex digit.

(vi) Pair Disk Name

The logical disk name of paired volume is displayed.

(vii) Activity State

The replication operation status is displayed.

Display	Description
Replicate	Indicates the status that copy is executing from MV to RV.
Separate	Indicates the disconnection status of MV to RV.
Restore	Indicates the status that copy is executing from RV to MV.
Restore (protect)	Indicates the state in which data is being copied from the RV into MV but the updated data of the MV is not reflected into the RV.

(viii) Disk Array

The identification name given to the Disk Array including the volume indicated by “Pair Number” is displayed.

It is the same as the Disk Array Name displayed in the main screen (State Monitoring screen), and can be changed from the main screen (State Monitoring screen).



If the Replication does not recognize the link destination of the disk array when the link is established between disk arrays, the disk array name may be displayed as the address value (Subsystem Absolute Address), which can uniquely identify the disk array not duplicated with other disk arrays.

(ix) Sync State

The transition status in activity state is displayed.

For more information, refer to 2.3 “Replication Operations and State Transitions”.

Display	Description
Separating	Indicates the temporary status that difference between MV and RV is reducing to zero during Separation Execution.
Separated	Indicates the status that the data copying is not processing between MV and RV. It becomes this status right after pair setting.
Forced Separation	Indicates the status that MV and RV are separated forcibly by the forced separate instruction.
Fault	Indicates the status of forced separation inside the disk array due to copy fault occurrence.
Sync Execution	Indicates the status that difference exists while copy is executing.
Synchronized	Indicates the status that reflection of the difference between the MV and RV at the copy start instruction has been completed. Updates to the MV are reflected on the RV sequentially for the pair in this state.
Restoring	Indicates the status that difference between MV and RV is not reflected at the time of restore execution.
Restored (synchronized)	Indicates the status that difference between MV and RV is reflected at the time of restore execution. Updated MV content is reflected to RV.

(x) Copy Control State

The control status in copying is displayed.

For more information, refer to 2.4 “Copy Control State”.

Display	Description
Foreground Copy	Indicates the copy state in the synchronous or semi-synchronous mode.
Background Copy	Indicates the asynchronous copy state by difference management.
Freeze	Indicates that the data replication function is frozen.
Suspend	Indicates that copy operation is suspended.
Abnormal Suspend	Indicates that copy is forcibly suspended in the disk array due to a copy fault.

(xi) Copy Mode

The copy control state in the synchronous state during Replicate/Restore is displayed.

Display	Description
Synchronous	This mode completes copying to RV within the processing time of the command for writing to MV.
Semi-synchronous	This mode stops the command for writing to MV and immediately performs copying to RV.
Background Copy	This mode performs copying to RV asynchronously after stopping the command for writing to MV.

(xii) RV Mode

RV access restrictions are displayed. For more information, refer to 2.6 “RV Access Restriction”.

Display	Description
R/W Permit	Indicates that the volume can be read and written from the host.
Read Only	Indicates that the volume can be only read from the host.
Not Ready	Indicates that the volume cannot be operated from the host.
Not Available	Indicates that the volume cannot be operated from any host.

(xiii) Differential Quantity of Volume

Indicates the amount of difference after Separate (including the state right after pair setting) and the amount of difference (the remaining amount) during synchronous execution.

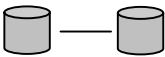

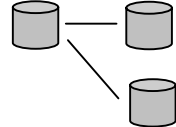
Amount of difference may not change if I/O load is too heavy.

If a link failure occurs, amount of difference may not change. In this case, refer to 2.2.2 (2) “Link fault” in the “Data Replication User’s Manual (Installation and Operation Guide for Windows)”.

(xiv) Number of Pairs

Indicates the number of related pairs. This value is equal to “the number of volumes which make up the pair link” minus 1.

An example of pair relations and Number of Pairs is shown below.

Number of Pairs	Pair Relation
1	
2	
2	

Some replication operations cannot be carried out while in the Replicate state, Restore state, or Separate execution if the pair relation has multiple layers or if multiple RVs are connected to one MV (Refer to the execution conditions of the operations). If the Number of Pairs is 2 or greater, check the hierarchy in the Connection screen.

(xv) Capacity [GB]

Indicates the capacity of the logical disk.

(xvi) LD Set Name

Indicates the name of the LD Set to which the volume belongs.

(xvii) ATgroup Name

Indicates the name of the AT-group to which the volume belongs.

* For details on the AT-group, refer to the “Data Replication User’s Manual (Disaster Recovery System Installation and Operation Guide)”.

3.2.4 Disk Array LINK Information Screen

When you click the [Disk Array LINK Information] tab in the information list display area, the link information currently set between the disk arrays is displayed (refer to Figure 3-4 “Example of Disk Array LINK Information Screen”).

To perform sort, click the item name by which you want to sort. You can drag&drop an item to permute the order of the items.







Replication Information		Disk Array LINK Information		ATgroup Information	
LINK Number	LINK Disk Array Name	Path Number	Path State	Director Number	
 00h	Storage4100/0010	00h	Normal	16h	
 00h	Storage4100/0010	01h	Normal	1eh	

Figure 3-4 Example of Disk Array LINK Information Screen

The Disk Array LINK Information screen displays information regarding the following items.

(i) LINK Number

Indicates the number of the linked disk arrays. The link number "0" is allocated to the first disk array, and "1" to the second disk array (refer to Figure 3-5 “Replication Link Information”). The icon shows the following path status.

Icon	Description
 (Green)	Indicates the status of normal or link checking.
 (Gray)	Indicates the offline status.
 (Light Blue)	Indicates the status that the data replication function is frozen.
 (Red)	Indicates that a fault occurs.

(ii) LINK Disk Array Name

Indicates the identification name assigned to the linked disk array.

(iii) Path Number

Indicates the connection path number in the link.

If the link is connected via four paths, the path numbers are 0, 1, 2, and 3, respectively (refer to Figure 3-5 “Replication Link Information”).

(iv) Path State

Display	Description
Normal	Indicates the normal status.
Offline	Indicates that the link setting is unconfirmed during startup of the disk array.
Freeze	Indicates that the Data Replication function in the target disk array is frozen.
Link Checking	Indicates that the link status is being checked due to a failure of communication in the link. It transits to Normal or Fault after a certain time interval.
Fault	Indicates that the link is invalid due to a failure of communication in the link.

(v) Director Number

Indicates the replication director number (host director for the S2400 and 2800 series) that the link is set.

Figure 3-5 shows an example of two disk arrays connected to Disk Array 1 for using RDR. The following shows an example of 3000/4000 series.

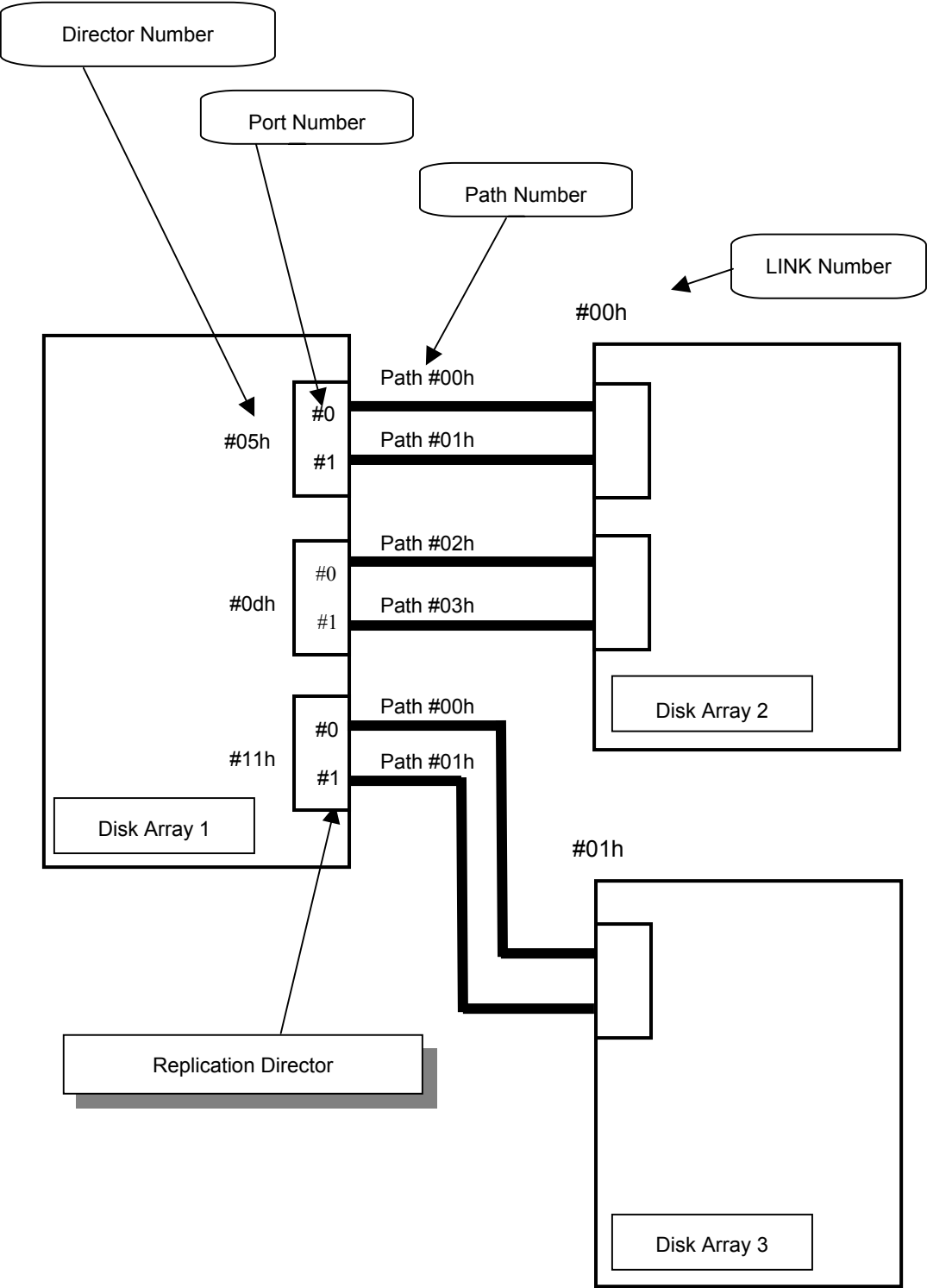


Figure 3-5 Replication Link Information

3.2.5 Menu Item List

The list of menu bar items of Replication Management is shown below. For details, refer to description on each menu item.

Repli - Storage4300

FileViewOperationHelp

CSV Output of Information List Display...

Save the Pair Setting Information...

CloseAlt+F4

3.3.13 "CSV Output of Information List Display"

3.3.14 "Save Pair Setting Information"

Closes the Replication screen.

Storage4300

ViewOperationHelp

✓ Status Bar

✓ IV Display

Copy Fault List...

Record Screen Information

Environment Setting...

Properties...

RefreshF5

Shows or hides the status bar.

Shows or hides IVs.

3.4.8 "Display Copy Fault List"

3.4.5 "Record Screen Information"

3.4.3 "Environment Setting"

3.3.12 "Displaying Volume Connection State"
(when "Connection Screen" is displayed)

3.4.6 "Display Disk Array Properties" (when
Disk Array is selected from configuration
display area and "Properties" is displayed)

3.4.7 "Display Link Properties" (when
Director Port is selected from Disk Array
LINK Information Screen and "Properties" is
displayed)

3.4.4 "Refresh"

Repli - Storage4300

OperationHelp

Pair Setting...

Unpair...

Volume Operation

Forced Operation

System Operation

ATgroup

Replicate...

Separate...

Restore...

Suspend Copy...

Resume Copy...

Change to Background Copy...

RV Mode Change...

3.3.1 "Pair Setting/Unpair"

3.3.1 "Pair Setting/Unpair"

3.3.2 "Replicate"

3.3.3 "Separate"

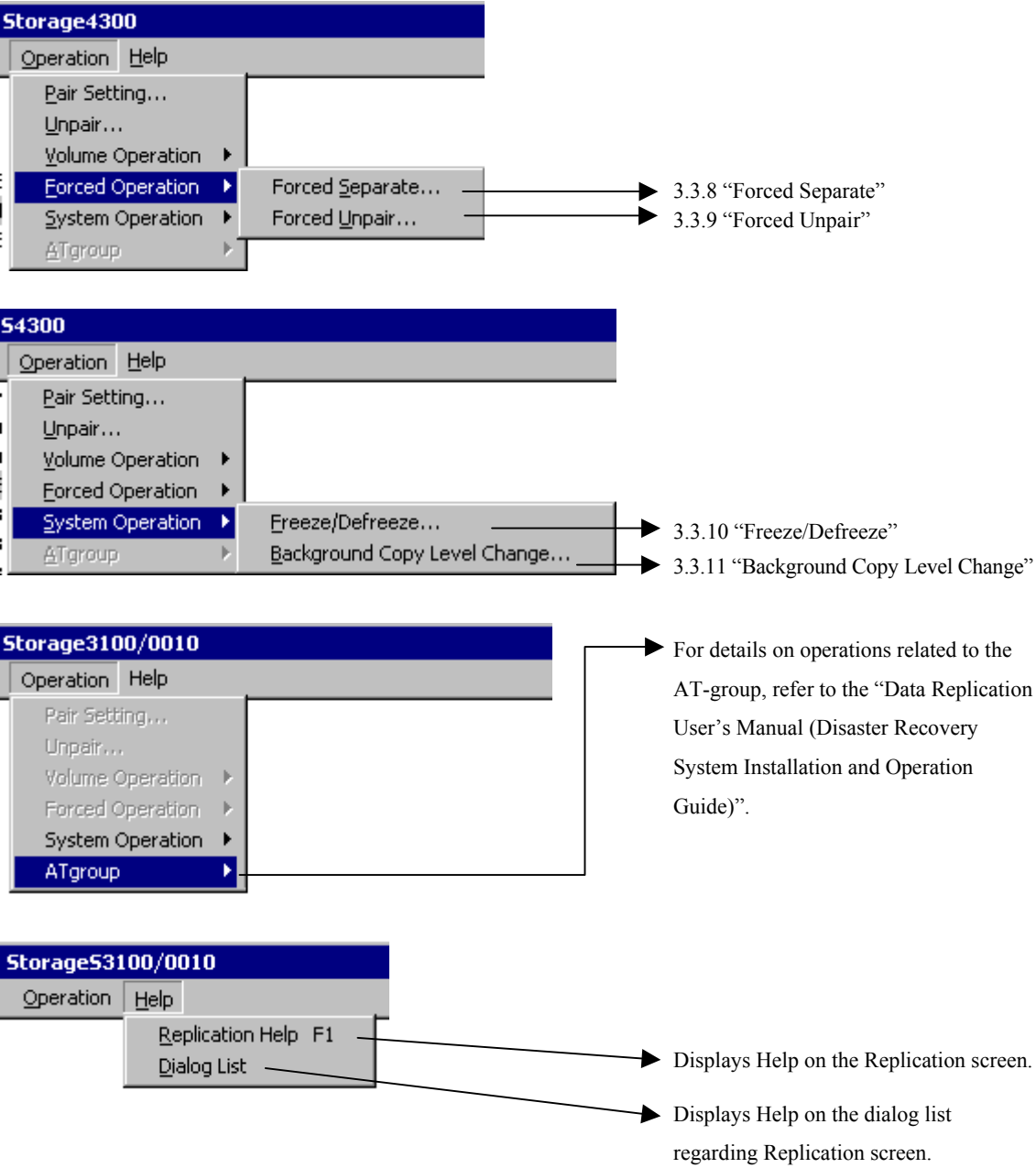
3.3.4 "Restore"

3.3.5 "Suspend/Resume Copy"

3.3.5 "Suspend/Resume Copy"

3.3.6 "Change to Background Copy"

3.3.7 "RV Mode Change"



3.2.6 Information Displayed on Execution Dialog

The Execution dialog displayed for replication operations can be switched to [Summary] or [Details] display mode for the volume-related information displayed.

In the description given below, the unpair execution dialog is used as an example. You can read “operation” in the description as “Replicate”, “Restore”, etc. to be carried out.

Figure 3-6 shows an example of an Execution dialog information screen.

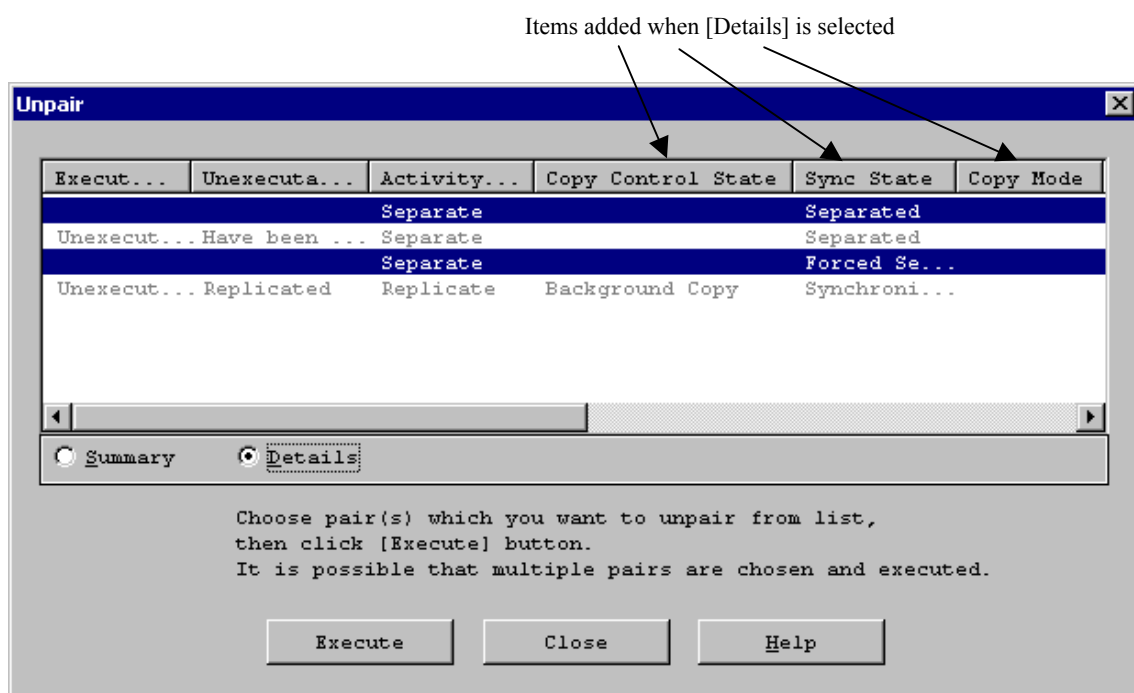


Figure 3-6 Example of Execution Dialog Information Screen

Information on the following items is displayed on the information screen of the execution dialog.

* Items (v), (vi), and (vii) are displayed only when [Details] is selected.

(i) Execution Result

Displays the execution result of the operation. Operation cannot be performed for a pair with “Unexecutable”.

After the operation is executed, the execution results for the operation are displayed. To check on the progress after the operation, close the execution dialog and check the progress on the Connection Screen.

(ii) Unexecutable Information

Displays the reason why operation cannot be performed.

(iii) Activity State

Displays the execution state of the pair.

- (iv) Logical Disk Name
Displays the logical disk name of MV.
- (v) Copy Control State
Displays the control state during copy.
- (vi) Sync State
Displays the transition status in the activity state.
- (vii) Copy Mode
Displays the Synchronous/Semi-synchronous mode during copy operation.
- (viii) Number
Displays the logical disk number of MV.
- (ix) MV Disk Array Name
Displays the disk array name to which MV belongs.
- (x) Pair Disk Name
Displays the logical disk name of RV.
- (xi) Pair Number
Displays the logical disk number of RV.
- (xii) RV Disk Array Name
Displays the disk array name to which RV belongs.
- (xiii) ATgroup Name
Displays the name of the AT-group to which the volume belongs.

3.3 Various Operations of Replication Management

3.3.1 Pair Setting/Unpair

To perform replication operations, you must set pairs beforehand.

To set a pair, set the original volume as MV and the target volume as RV. You can also use the volume you have set as RV in another pair by setting it as MV.

You can set pairs freely within the following bounds.

- You can set up to three volumes of RVs (dRVs) or up to four volumes of RVs (including rRV) for one MV at the same time.
- You can set RVs in up to 2 disk arrays for one PV.
- You can set DynamicDataReplication only for one layer in the disk array.
- You can set a pair only when the two volumes have the same capacity.

Figure 3-7 shows an example of the pair setting.

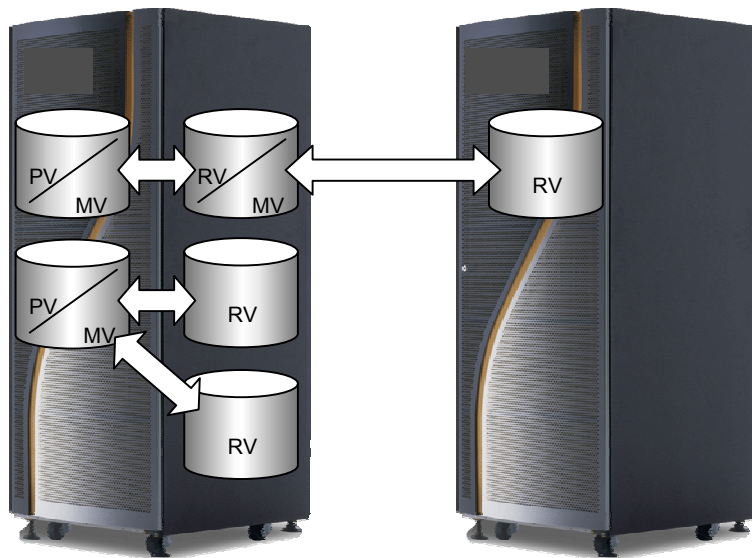


Figure 3-7 Example of Pair Setting

You may want to specify multiple pairs simultaneously, for example, when you initially build or rebuild a replication environment. To specify pair environments at a time, use “Replication Setting” of “New Setting” which is one of the configuration setting functions. For details, refer to the “Configuration Setting Tool User’s Manual (GUI)” and 3.4.2 “Save Pair Setting Information”.

[Operation Procedure]

Pair Setting

Do one of the following to display the Pair Setting screen.

- Select a volume in the Replication Information screen, click [Operation] on the menu bar of the Replication screen, and then select [Pair Setting].
- Right-click in the Replication Information screen, and then select [Pair Setting].

In pair setting, whether the selected volume can be set as MV is determined automatically. If the selected volume is a volume for which pair setting cannot be performed as MV, the following prompt appears.

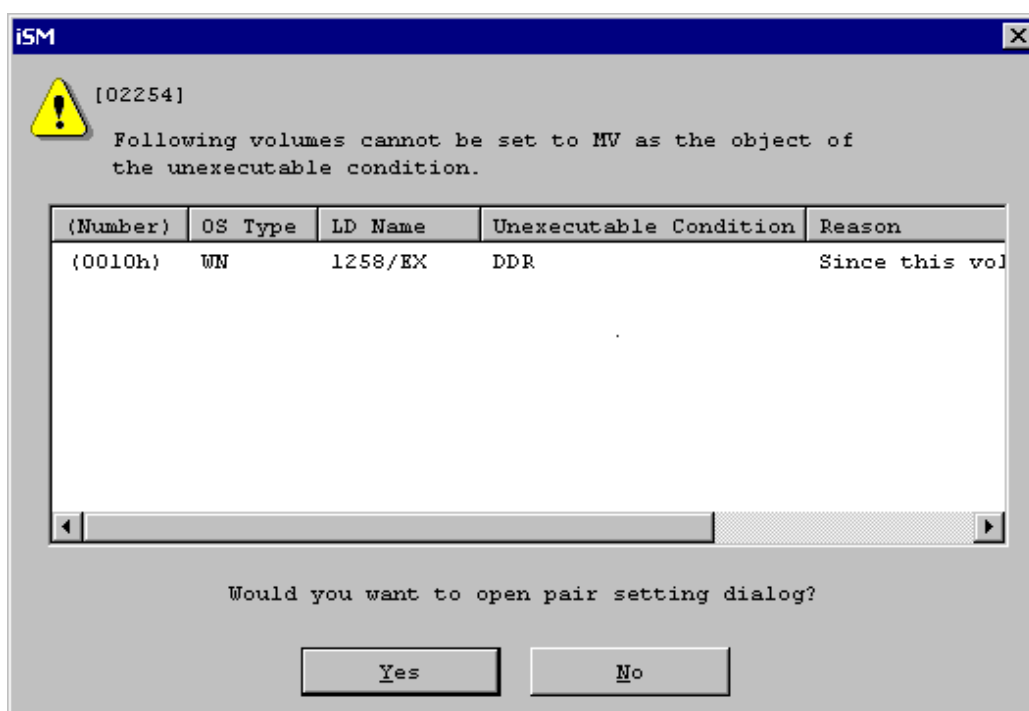


Figure 3-8 Confirmation Screen

The possible causes are as follows:

Unexecutable condition	Description
DDR/RDR	Due to the description of the reason, the volume cannot be set as MV of DDR and RDR.
DDR	Due to the description of the reason, the volume cannot be set as MV of DDR.
RDR	Due to the description of the reason, the volume cannot be set as MV of RDR.

After checking the message, click the [Yes] button to display the Pair Setting screen. To select a volume again on the Replication Information screen, click the [No] button.

Figure 3-9 shows an example of the Pair Setting Screen.

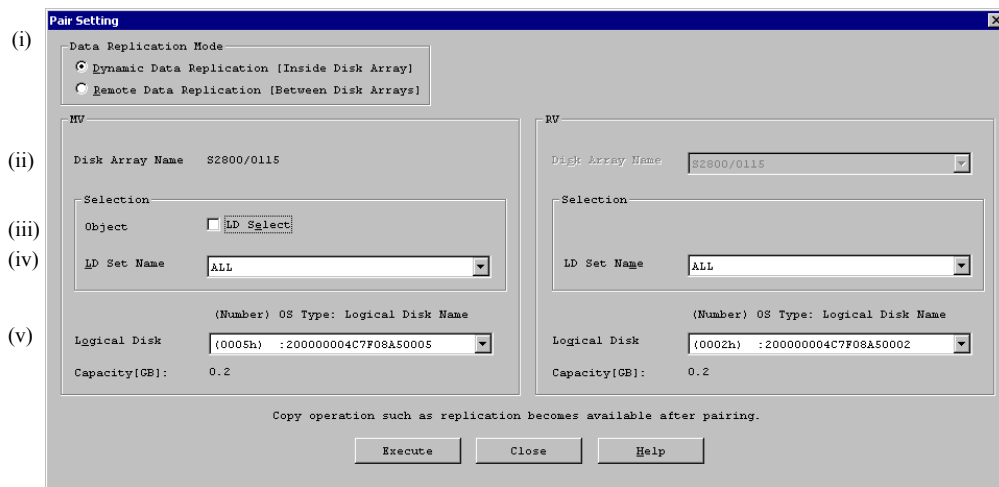


Figure 3-9 Example of Pair Setting Screen

After the Pair Setting, the copy operation such as Replicate, Restore etc. is available.

(i) Data Replication Mode

Select the method of setting pairs.

Radio Button	Description
Dynamic Data Replication (within a Disk Array)	MV and RV use the volumes in the same Disk Array.
Remote Data Replication (between Disk Arrays)	MV and RV use the volumes in different Disk Arrays.

(ii) Disk Array Name

On the MV part, displays the disk array name with the selected volume.

On the RV part, displays the disk array name for which pair setting of remote data replication can be performed.

(iii) Object

To make only the selected volume the object of MV, check this (default).

To make all the volumes that can be used as MV the objects, uncheck this.

(iv) LD Set Name

You can narrow down object volumes for which pair setting can be performed by the LD Set Name.

When the object volume for which pair setting can be performed is not registered in the LD Set, LD Set Name cannot be used for narrowing down nor selected.

- ALL : All volumes become selectable objects.
- LD Set Name : Volumes registered in the selected LD Set become selectable objects.
- Undefined : Volumes not registered in the LD Set become selectable objects.

(v) Logical Disk

Select the Logical Disk which you want to set.

When you click the [Execute] button, the following message is displayed.

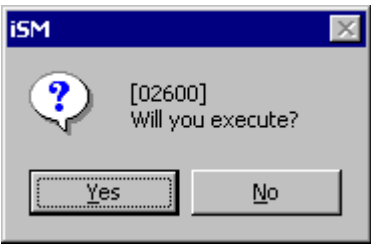


Figure 3-10 Confirmation Screen

Unpair

Do one of the following to display the Unpair screen.

- Select a volume in the Replication Information screen, click [Operation] on the menu bar of the Replication screen, and then select [Unpair].
- Right-click in the Replication Information screen, and then select [Unpair].

Figure 3-11 shows an example of the Unpair screen.

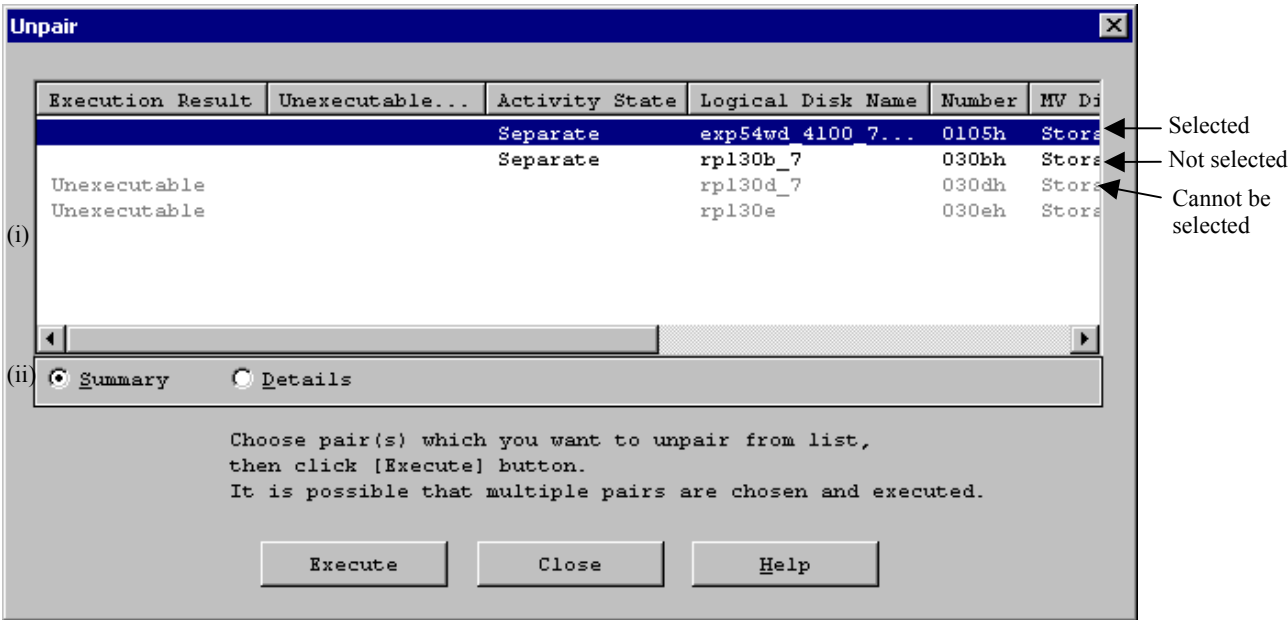


Figure 3-11 Example of Unpair Screen

From the list, select a pair you want to unpair, and then click the [Execute] button.

You can select multiple executable pairs and execute them in a batch.

Unexecutable pairs cannot be selected.

(i) Selected Volume List

Displays the list of the pair (MV/RV) information selected in the Replication Information screen.

Volumes whose Execution Result is “Unexecutable” cannot be selected because they do not satisfy the execution conditions.

For the “Unexecutable” volumes, do the following by referring to the Unexecutable Information.

Unexecutable Information	Measure
Have Unpaired	Execute it for a volume with the pair setting.
Replicated	Change it to the Separated state and execute it again.
Restored	Change it to the Separated state and execute it again.
Separating	Execute it again in the Separated state.
Freeze	Defreeze the Data Replication function and execute it again.
MV Force Unpaired	Perform Forced Unpair for RV.
MV Monitoring Suspended	Change the disk array of MV to the Monitored state and execute it again.
RV Monitoring Suspended	Change the disk array of RV to the Monitored state and execute it again.
RV Force Unpaired	Perform Forced Unpair for MV.
MV Outside iSM Management	Execute it for a pair under the iSM management.
All Link Path Abnormal	Refer to 2.2.2 (2) “Link fault” in the “Data Replication User’s Manual (Installation and Operation Guide for Windows)” to recover from the failure.
Have been registered to ATgroup	Execute it for a pair that is not registered in the AT-group. Or, execute it after deleting a volume from the AT-group.

(ii) Summary Display/Details Display

For more information on this item, refer to 3.2.6 “Information Displayed on Execution Dialog”.

When you click the [Execute] button, the following message is displayed.

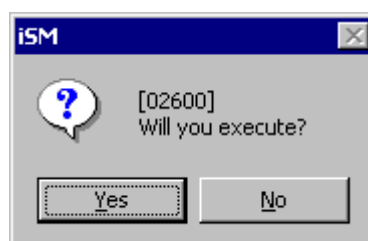


Figure 3-12 Confirmation Screen

[Execution Conditions]

To Pair setting or Unpair, the following conditions must be satisfied.

Conditions for Pair setting

Volumes in which the pair setting is performed must satisfy the following conditions.

- (i) The volume capacities of MV and RV match.
- (ii) The specified RV is not set as RV for another pair.
- (iii) If the specified MV is set as MV for another pair, the maximum number of simultaneous pairs is not exceeded.
- (iv) The volume formats match.
- (v) The pair hierarchy does not form any loop.
- (vi) When MV and RV exist in the same disk array and if RV is used to set another pair, a volume in another disk array is specified.
- (vii) The disk array where the specified MV and RV are stored is monitored.
- (viii) The disk array where the specified MV and RV are stored is not in the Freeze state.
- (ix) If the specified MV is registered in the AT-group, the MV and the specified RV are set as a DDR pair.
- (x) A volume having snapshot attributes other than BV is not set as MV.
- (xi) A volume having snapshot attributes is not set as RV.



Do not execute Pair Setting for a reserved volume of the business server or for a volume specified as a performance optimization work disk. The replication screen does not display the Volume List.

Conditions for Unpair

Volumes for unpair must satisfy the following conditions.

- (i) The specified MV and RV are paired.
- (ii) The specified MV and RV are in the Separated state.
- (iii) The disk array where the specified MV and RV are stored is monitored.
- (iv) The disk array where the specified MV and RV are stored is not in the Freeze state.
- (v) The specified MV is not registered in the AT-group.



RV unmounted by the ReplicationControl function from a business server or backup server of Windows may be set in the Not Ready state. In this case, even if the synchronous state of the pair is “separated”, the RV mode is kept in the Not Ready state.

Make sure to change the RV set in the Not Ready state to the R/W Permit state by “RV mode change” operation prior to unpair with the exception of the case where the logical disk of RV is used by a business server or backup server in succession after unpair.

3.3.2 Replicate

When you perform Replicate for volumes with the pair setting, copy from MV to RV starts.

[Operation Procedure]

Do one of the following to display the Replicate screen.

- Select a volume in the Replication Information screen, click [Operation] on the menu bar of the Replication screen, point to [Volume Operation], and then select [Replicate].
- Right-click in the Replication Information screen, point to [Volume Operation], and then select [Replicate].

Figure 3-13 shows an example of the Replicate screen.

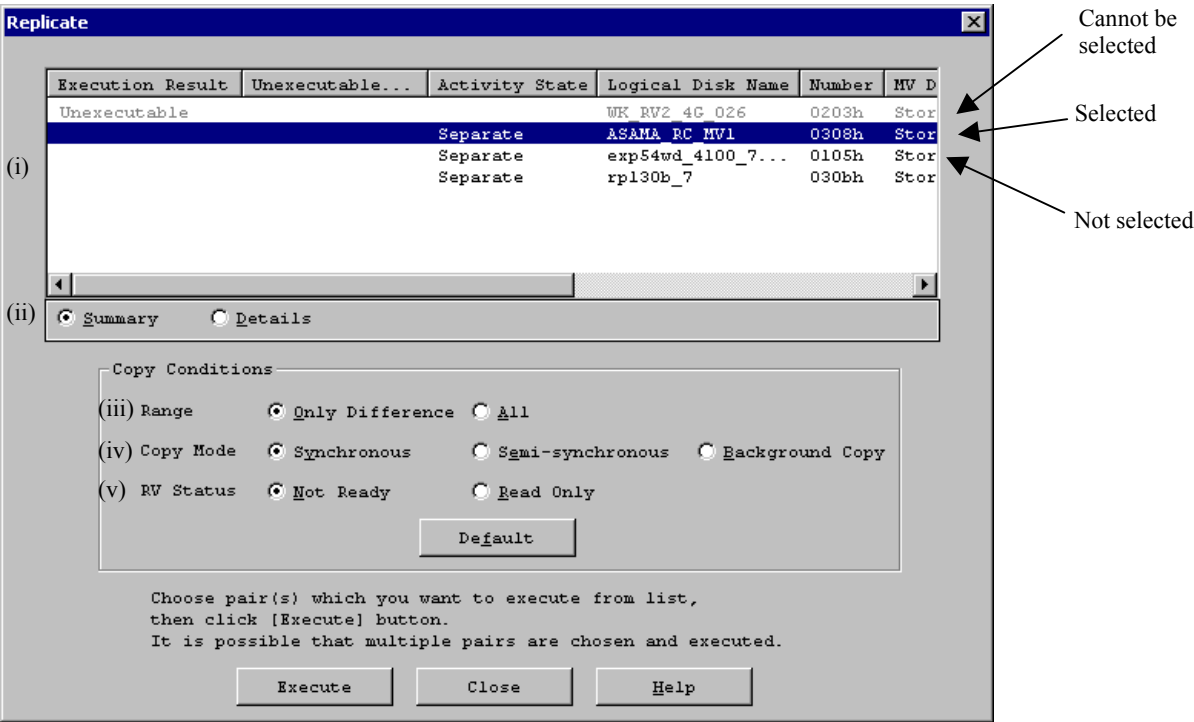


Figure 3-13 Example of Replicate Screen

From the list, select a pair for which you want to perform the operation, and then click the [Execute] button.

You can select multiple executable pairs and execute them in a batch.

Unexecutable pairs cannot be selected.

(i) Selected Volume List

Displays the list of the pair (MV/RV) information selected in the Replication Information screen.

Volumes whose Execution Result is “Unexecutable” cannot be selected because they do not satisfy the execution conditions.

For the “Unexecutable” volumes, do the following by referring to the Unexecutable Information.

Unexecutable Information	Measure
Have Unpaired	Execute it for a volume with the pair setting.
Replicated	Execute it for a volume in the Separate state.
Restored	Execute it for a volume in the Separate state.
Being replicated by other pair	Replicate is being executed in another layer. Execute it again after Separate is complete.
Being restored by other pair	Restore is being executed in another layer. Execute it again after Separate is complete.
Freeze	Defreeze the Data Replication function and execute it again.
Being separated by other pair	Separate is being executed in another layer. Execute it again after Separate is complete.
MV Monitoring Suspended	Change the disk array of MV to the Monitored state and execute it again.
RV Monitoring Suspended	Change the disk array of RV to the Monitored state and execute it again.
MV Force Unpaired	Perform Forced Unpair for RV.
RV Force Unpaired	Perform Forced Unpair for MV.
MV Outside iSM Management	Execute it for a pair under the iSM management.
All Link Path Abnormal	Refer to 2.2.2 (2) “Link fault” in the “Data Replication User’s Manual (Installation and Operation Guide for Windows)” to recover from the failure.
Have been registered to ATgroup	Execute it for a pair that is not registered in the AT-group.
Snapshotting	Execute it for a pair that is not operating snapshot.

(ii) Summary Display/Details Display

For more information on this item, refer to 3.2.6 “Information Displayed on Execution Dialog”.

(iii) Range

Normally, Only Difference is selected, which copies only the difference area of MV and RV.

You can also select All, which copies the entire area explicitly.

Radio Button	Description
Only Difference	Copies only the difference of the volumes.
All	Copies the entire volume.

(iv) Copy Mode

You can specify the copy control state in Replicate Execution and the Synchronous state at the same time as Replicate. The following copy modes can be specified.

Radio Button	Description
Synchronous	Changes the copy control state to the foreground copy (Synchronous) mode.
Semi-synchronous	Changes the copy control state to the foreground copy (Semi-synchronous) mode. This can be specified for pairs in different disk arrays.
Background Copy	Changes the copy control state to the Background Copy state.

(v) RV Status

Specifies the access restrictions from the host until Replicate is complete.

Radio Button	Description
Not Ready	Operations for the volume cannot be performed from the host.
Read Only	For the volume, only read can be performed from the host.

* Care should be taken to specify Read Only. Refer to 2.6 “RV Access Restriction”.

When you click the [Execute] button, the following message is displayed.

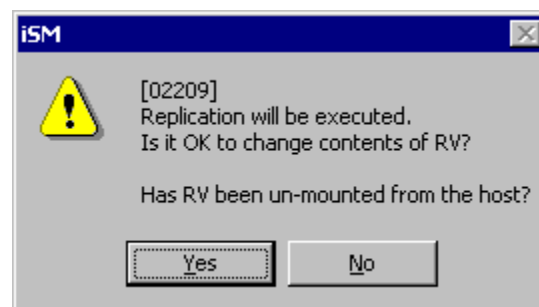


Figure 3-14 Confirmation Screen

[Execution Conditions]

To perform Replicate, the following conditions must be satisfied.

- (i) The target MV is recognized by Replication Management as the Replication target disk.
- (ii) The target MV and RV are paired.
- (iii) The activity state of the target pair is Separate.
- (iv) The Semi-synchronous Copy mode cannot be specified for pairs set in the same disk array.
The Semi-synchronous Copy mode can be specified only for pairs set in different disk arrays.
- (v) The pair of the specified MV and the paired RV pair are not in the Restore state.

- (vi) The activity state of the pair of the specified MV and the paired upper MV is not in the Restore state.
- (vii) The activity state of the pair of the specified RV and the paired lower RV is not in the Restore state.
- (viii) The disk array where the specified MV and RV are stored is not Freeze state.
- (ix) The disk array where the specified MV and RV are stored is monitored.
- (x) The RV has been unmounted from the host.
- (xi) The specified MV is not registered in the AT-group.
- (xii) Separate is not being performed between the upper volume and the lower volume that are paired.
- (xiii) Snapshot is not in operation.

Figure 3-15 illustrates the execution conditions of Replicate. (Each of (i) to (xiii) in the figure corresponds to the respective number above.)

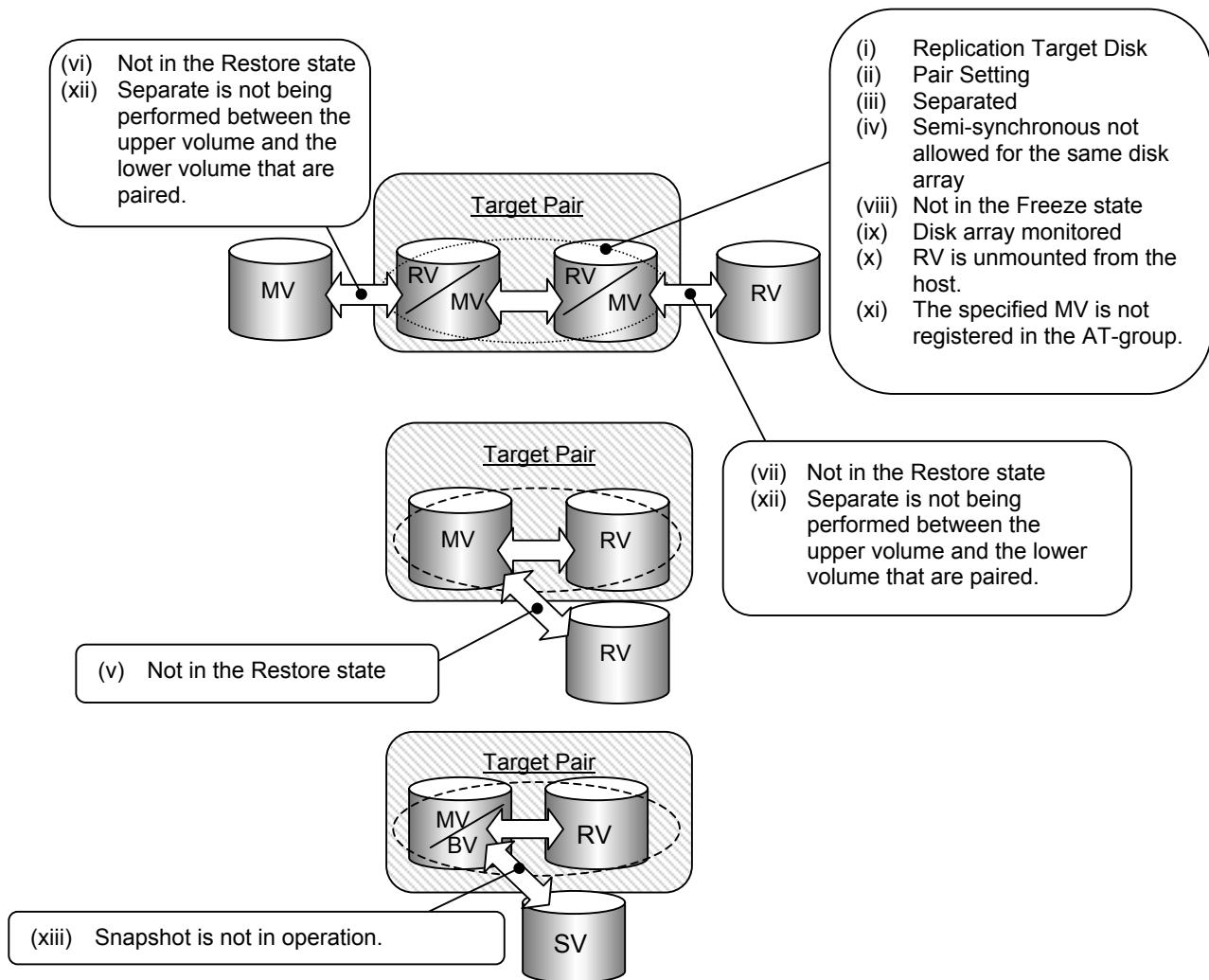


Figure 3-15 Execution Conditions of Replicate

3.3.3 Separate

If Separate is performed for paired volumes, MV is separated from RV and RV is made available. RV cannot be reused until Separate is completed. However, it can be used for Separate(immediate).

[Operation Procedure]

Do one of the following to display the Separate screen.

- Select a volume in the Replication Information screen, click [Operation] on the menu bar of the Replication screen, point to [Volume Operation], and then select [Separate].
- Right-click in the Replication Information screen, point to [Volume Operation], and then select [Separate].

Figure 3-16 shows an example of the Separate screen.

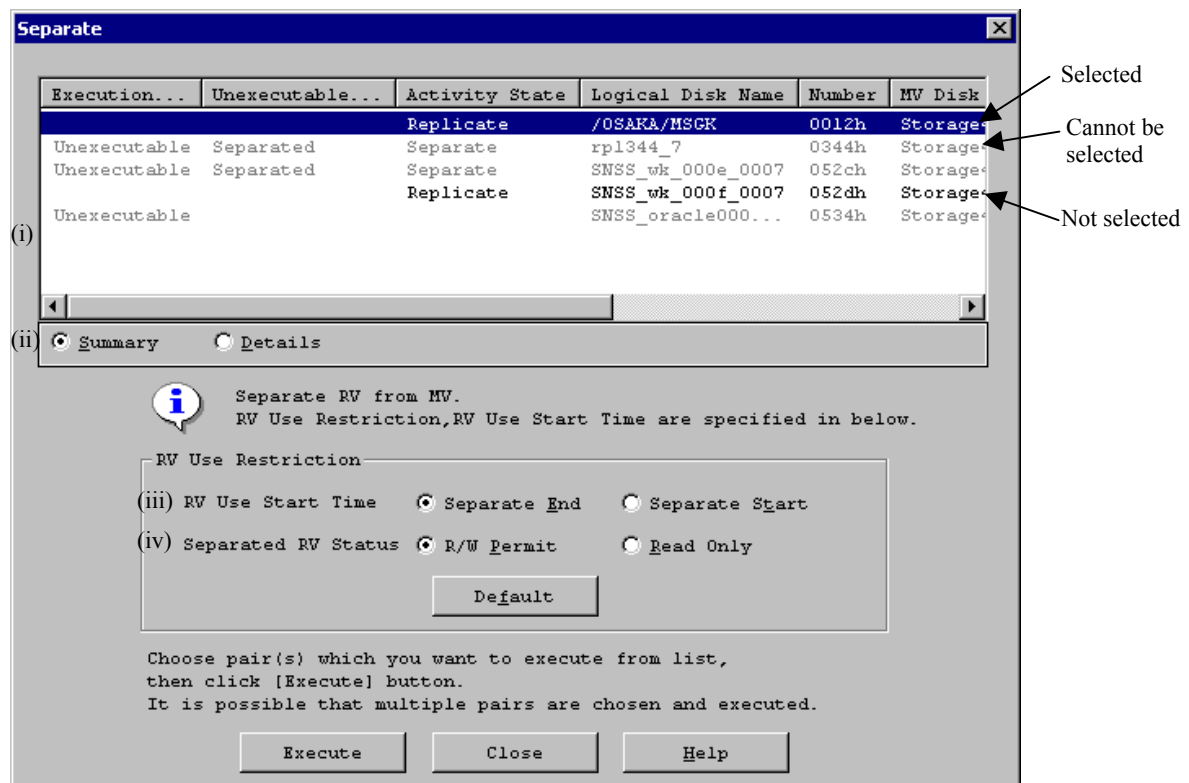


Figure 3-16 Example of Separate Screen

From the list, select a pair for which you want to perform the operation, and then click the [Execute] button.

You can select multiple executable pairs and execute them in a batch.

Unexecutable pairs cannot be selected.

(i) Selected Volume List

Displays the list of the pair (MV/RV) information selected in the Replication Information screen. Volumes whose Execution Result is “Unexecutable” cannot be selected because they do not satisfy the execution conditions.

For the “Unexecutable” volumes, do the following by referring to the Unexecutable Information.

Unexecutable Information	Measure
Have Unpaired	Execute it for a volume with a volume of the Synchronous state.
Separated	Execute it for a volume in the Synchronous state.
Restoring	Execute it again when Restored is completed.
Suspend State	Execute it again in the Synchronous state after copy is resumed.
Abnormal Suspend	Refer to 2.2.2 “HW Fault Unique to Replication” in the “Data Replication User’s Manual (Installation and Operation Guide for Windows)” to recover from the failure.
Freeze	Defreeze the Data Replication function and execute it again.
MV Monitoring Suspended	Change the disk array of MV to the Monitored state and execute it again.
RV Monitoring Suspended	Change the disk array of RV to the Monitored state and execute it again.
MV Force Unpaired	Perform Forced Unpair for RV.
RV Force Unpaired	Perform Forced Unpair for MV.
RV Forced Separate	Execute it for a volume in the Synchronous state.
MV Outside iSM Management	Execute it for a pair under the iSM management.
All Link Path Abnormal	Refer to 2.2.2 (2) “Link fault” in the “Data Replication User’s Manual (Installation and Operation Guide for Windows)” to recover from the failure.
Have been registered to ATgroup	Execute it for a pair that is not registered in the AT-group.

(ii) Summary Display/Details Display

For more information on this item, refer to 3.2.6 “Information Displayed on Execution Dialog”.

(iii) RV Use Start Time

Determine when to make the RV available.

Radio Button	Description
Separate End	After Separate execution, the RV becomes available when the difference between the MV and RV contents has been reflected into the RV (Separate(completion)).
Separate Start	After Separate execution, the RV is immediately available while the difference between the MV and RV contents is being reflected into the RV (Separate(immediate)).

* DynamicDataReplication Ver2 needs to be installed for using this function. The function is available only for paired volumes in the same disk array.

(iv) Separated RV Status

Specifies the operation in response to a write request from the host after Separate is complete.

Radio Button	Description
R/W Permit	Read and write can be performed for a separated RV is complete from the host.
Read Only	Only read can be performed for a separated RV is complete from the host.

When you click the [Execute] button, the following message is displayed.

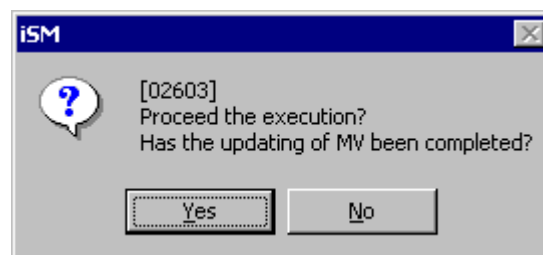


Figure 3-17 Confirmation Screen

[Execution Conditions]

To perform Separate, the following conditions must be satisfied. RV cannot be reused until Separate is completed. However, it can be used for Separate(completion).

- (i) The target MV is recognized by Replication Management as the Replication target disk.
- (ii) The target MV and RV are paired.
- (iii) The target pair is not in the Restore Execution state.
- (iv) The disk array where the specified MV and RV are stored is not in the Freeze state.
- (v) The disk array where the specified MV and RV are stored is monitored.
- (vi) The MV is unmounted from the host.
- (vii) The specified MV is not registered in the AT-group.
- (viii) Separate is not being performed between the upper volume and the lower volume that are paired.

Figure 3-18 illustrates the execution conditions of Separate. (Each of (i) to (viii) in the figure corresponds to the respective number above.)

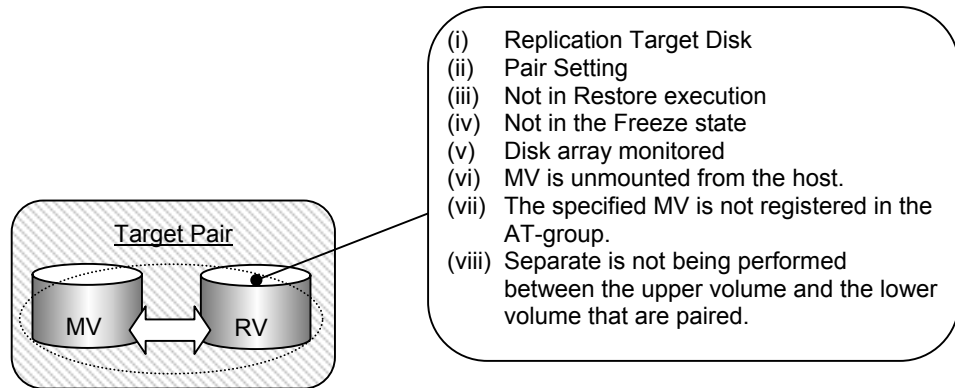


Figure 3-18 Execution Conditions of Separate

3.3.4 Restore

When you perform Restore for volumes with the pair setting, copy from RV to MV starts.

[Operation Procedure]

Do one of the following to display the Restore screen.

- Select a volume in the Replication Information screen, click [Operation] on the menu bar of the Replication screen, point to [Volume Operation], and then select [Restore].
- Right-click in the Replication Information screen, point to [Volume Operation], and then select [Restore].

Figure 3-19 shows an example of the Restore screen.

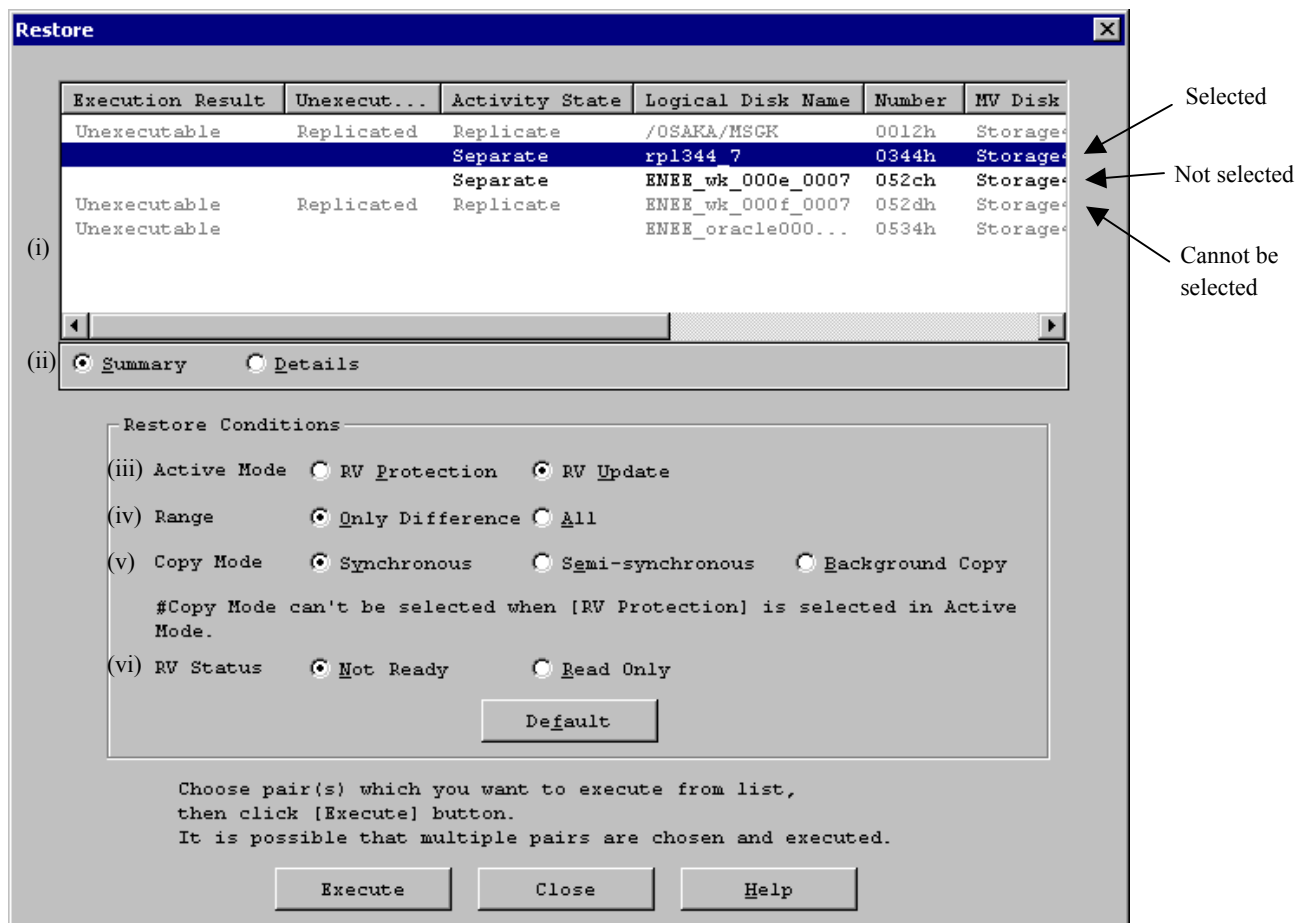


Figure 3-19 Example of Restore Screen

From the list, select a pair for which you want to perform the operation, and then click the [Execute] button.

You can select multiple executable pairs and execute them in a batch.

Unexecutable pairs cannot be selected.

(i) Selected Volume List

Displays the list of the pair (MV/RV) information selected in the Replication Information screen.

Volumes whose Execution Result is “Unexecutable” cannot be selected because they do not satisfy the execution conditions.

For the “Unexecutable” volumes, do the following by referring to the Unexecutable Information.

Unexecutable Information	Measure
Have Unpaired	Execute it for a volume with the pair setting.
Replicated	Execute it for a volume in the Separate state.
Restored	Execute it for a volume in the Separate state.
Being replicated by other pair	Replicate is being executed in another layer. Execute it again after Separate is complete.
Being restored by other pair	Restore is being executed in another layer. Execute it again after Separate is complete.
Separating	Execute it again in the Separated state.
Freeze	Defreeze the Data Replication function and execute it again.
Being separated by other pair	Separate is being executed in another layer. Execute it again after Separate is complete.
MV Monitoring Suspended	Change the disk array of MV to the Monitored state and execute it again.
RV Monitoring Suspended	Change the disk array of RV to the Monitored state and execute it again.
MV Force Unpaired	Perform Forced Unpair for RV.
RV Force Unpaired	Perform Forced Unpair for MV.
MV Outside iSM Management	Execute it for a pair under the iSM management.
All Link Path Abnormal	Refer to 2.2.2 (2) “Link fault” in the “Data Replication User’s Manual (Installation and Operation Guide for Windows)” to recover from the failure.
Have been registered to ATgroup	Execute it for a pair that is not registered in the AT-group.
Snapshotting	Execute it for a pair not in snapshot operation.

(ii) Summary Display/Details Display

For more information on this item, refer to 3.2.6 “Information Displayed on Execution Dialog”.

(iii) Active Mode

Specify a Restore operation mode.

Radio Button	Description
RV Protection	Performs restoration without reflecting the updated data of the MV into the RV. When the restoration is completed, Separate is automatically executed. * To use this function for paired volumes located in the same disk array, the DynamicDataReplication Ver2 is necessary, and to use this function for paired volumes located in different disk arrays, the RemoteDataReplication Ver2 is necessary.
RV Update	Performs restoration while reflecting the updated data of the MV into the RV. When the restoration is completed, the state changes to Synchronous State (rst/sync).



The default operation mode in (iii) is “RV Protection”.

Confirm the Restore operation mode before executing Restore.

“RV Update” needs to be selected for executing Restore in the same operation mode as for Version1.4 or earlier.

If “RV Protection” is selected, selection of (v) Copy mode is not permitted.

(iv) Range

Normally, Only Difference is selected, which copies only the difference area of MV and RV.

You can also select All, which copies the entire area explicitly.

Radio Button	Description
Only Difference	Copies only the difference of the volumes.
All	Copies the entire volume.

(v) Copy Mode

You can specify the copy control state in Restore Execution and the Synchronous state at the same time as Restore. The following copy modes can be specified.

Radio Button	Description
Synchronous	Changes the copy control state to the foreground copy (Synchronous) mode.
Semi-synchronous	Changes the copy control state to the foreground copy (Semi-synchronous) mode. This can be specified for pairs in different disk arrays.
Background Copy	Changes the copy control state to the Background Copy state.

(vi) RV Status

Specifies the access restrictions from the host until Restore is complete.

Radio Button	Description
Not Ready	Operations for the volume cannot be performed from the host.
Read Only	For the volume, only read can be performed from the host. * Care should be taken to specify Read Only. Refer to 2.6 “RV Access Restriction”.

When you click the [Execute] button, the following message is displayed.

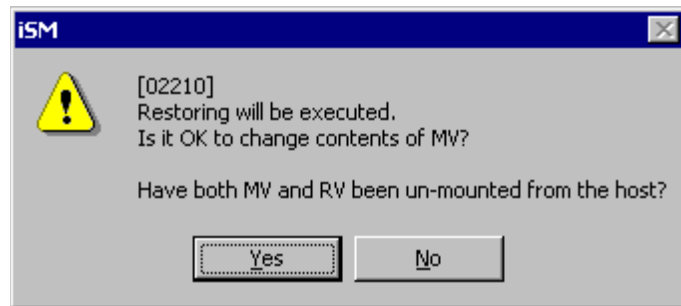


Figure 3-20 Confirmation Screen

[Execution Conditions]

To perform Restore, the following conditions must be satisfied.

- (i) The target MV is recognized by Replication Management as the Replication target disk.
- (ii) The target MV and RV are paired.
- (iii) The activity state of the target pair is Separate, but not Separate Execution.
- (iv) The Semi-synchronous Copy mode cannot be specified for pairs set in the same disk array.
The Semi-synchronous Copy mode can be specified only for pairs set in different disk arrays.
- (v) The activity state of the pair of the specified MV and the paired RV is Separate.
- (vi) The activity state of the pair of the specified MV and the paired upper MV is Separate.
- (vii) The activity state of the pair of the specified RV and the paired lower RV is Separate.
- (viii) The disk array where the specified MV and RV are stored is not in the Freeze state.
- (ix) The disk array where the specified MV and RV are stored is monitored.
- (x) The MV and RV are unmounted from the host.
- (xi) The specified MV is not registered in the AT-group.
- (xii) Separate is not being performed between the upper volume, the lower volume, and the derived volume that are paired.
- (xiii) Snapshot is not in operation.

Figure 3-21 illustrates the execution conditions of Restore. (Each of (i) to (xiii) in the figure corresponds to the respective number above.)

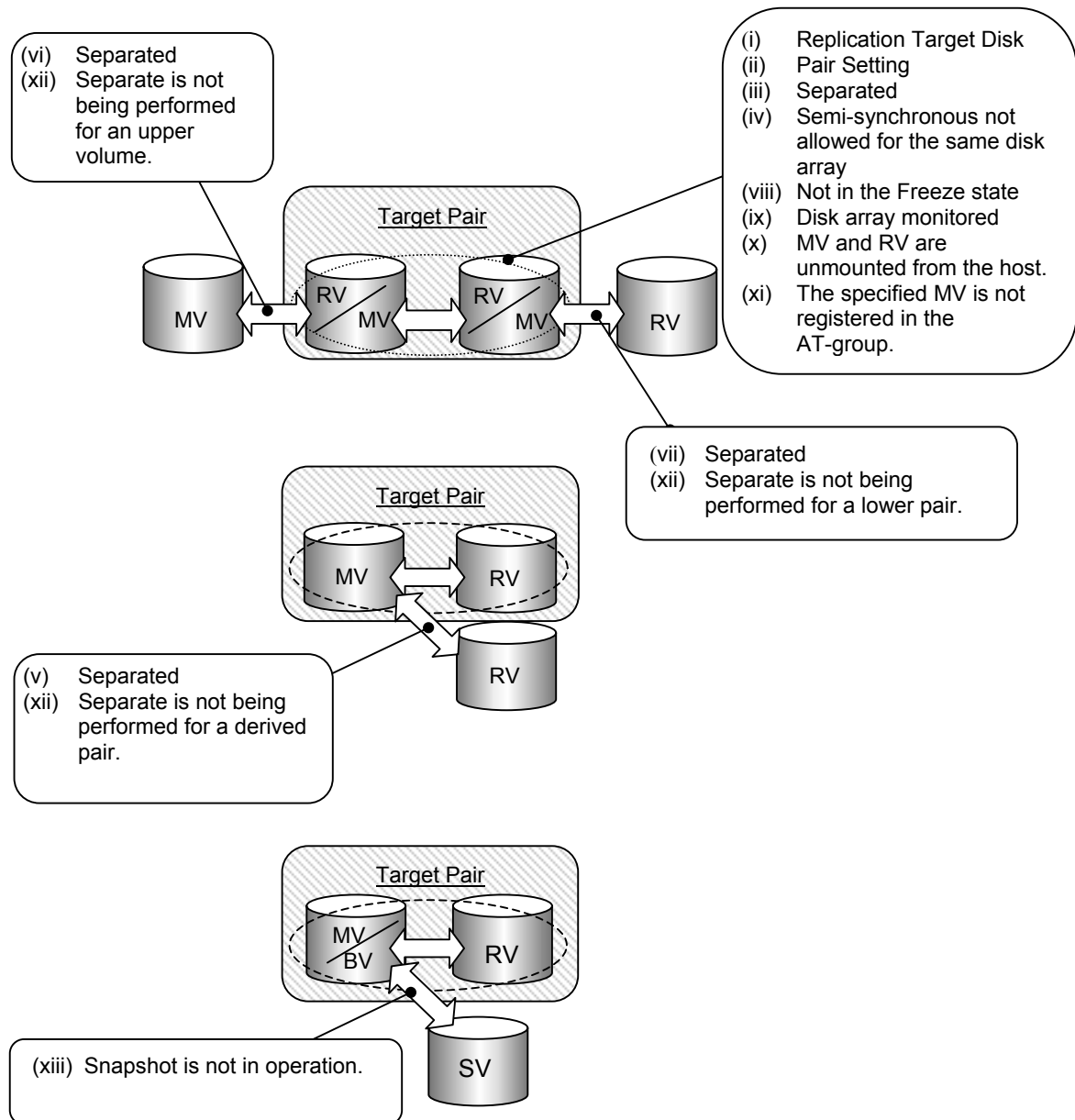


Figure 3-21 Execution Conditions of Restore

3.3.5 Suspend/Resume Copy

You can suspend and resume copy operation in the Replicate or Restore state.

[Operation Procedure]

Suspend Copy

The Foreground Copy or Background Copy state is changed to the Suspend Copy state.

Do one of the following to display the Suspend Copy screen.

- Select a volume in the Replication Information screen, click [Operation] on the menu bar of the Replication screen, point to [Volume Operation], and then select [Suspend Copy].
- Right-click in the Replication Information screen, point to [Volume Operation], and then select [Suspend Copy].

Figure 3-22 shows an example of the Suspend Copy screen.

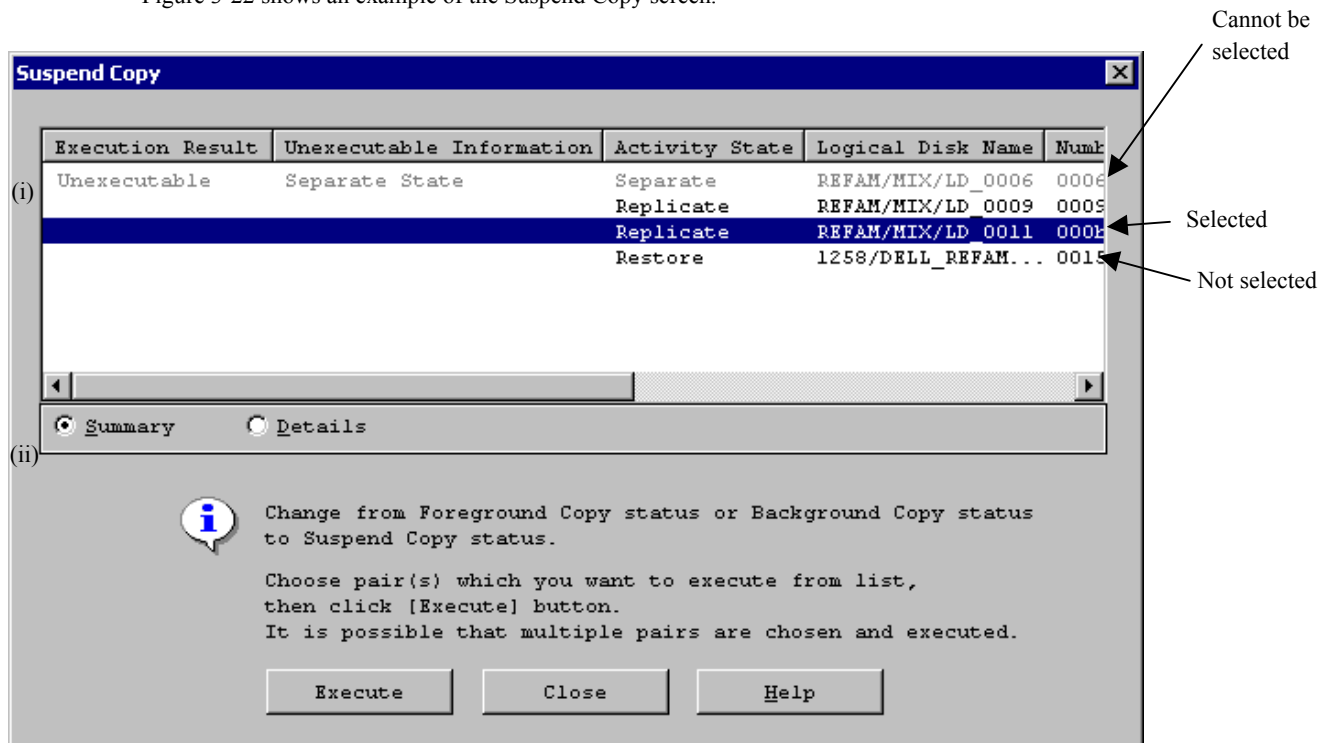


Figure 3-22 Example of Suspend Copy Screen

From the list, select a pair for which you want to perform the operation, and then click the [Execute] button.

You can select multiple executable pairs and execute them in a batch.

Unexecutable pairs cannot be selected.

(i) Selected Volume List

Displays the list of the pair (MV/RV) information selected in the Replication Information screen. Volumes whose Execution Result is “Unexecutable” cannot be selected because they do not satisfy the execution conditions.

For the “Unexecutable” volumes, do the following by referring to the Unexecutable Information.

Unexecutable Information	Measure
Have Unpaired	Execute it for a volume with the pair setting.
Already Suspended	Execute it for a volume in the Replicate state, Restore state.
Separate State	Execute it for a volume in the Replicate state or Restore state.
Freeze	Defreeze the Data Replication function and execute it again.
MV Monitoring Suspended	Change the disk array of MV to the Monitored state and execute it again.
MV Force Unpaired	Perform Forced Unpair for RV.
RV Force Unpaired	Perform Forced Unpair for MV.
RV Forced Separate	Execute it for a volume in the Synchronous state.
MV Outside iSM Management	Execute it for a pair under the iSM management.
All Link Path Abnormal	Refer to 2.2.2 (2) “Link fault” in the “Data Replication User’s Manual (Installation and Operation Guide for Windows)” to recover from the failure.
Have been registered to ATgroup	Execute it for a pair that is not registered in the AT-group.

(ii) Summary Display/Details Display

For more information on this item, refer to 3.2.6 “Information Displayed on Execution Dialog”.

Resume Copy

The Suspend Copy or Background Copy state is changed to the Foreground Copy state.

Do one of the following to display the Resume Copy screen.

- Select a volume in the Replication Information screen, click [Operation] on the menu bar of the Replication screen, point to [Volume Operation], and then select [Resume Copy].
- Right-click in the Replication Information screen, point to [Volume Operation], and then select [Resume Copy].

Figure 3-23 shows an example of the Resume Copy screen.

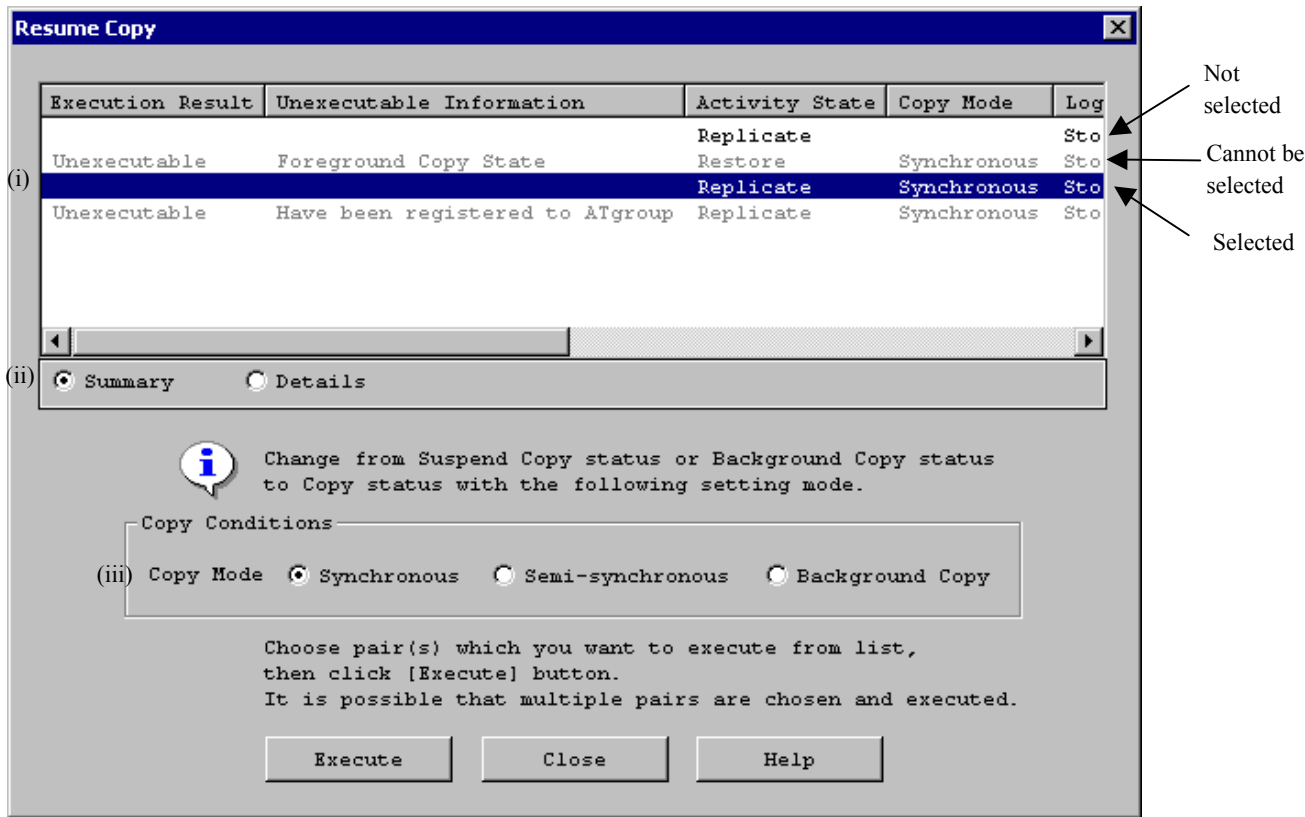


Figure 3-23 Example of Resume Copy Screen

From the list, select a pair for which you want to perform the operation, and then click the [Execute] button.

You can select multiple executable pairs and execute them in a batch.

Unexecutable pairs cannot be selected.

(i) Selected Volume List

Displays the list of the pair (MV/RV) information selected in the Replication Information screen.

Volumes whose Execution Result is “Unexecutable” cannot be selected because they do not satisfy the execution conditions.

For the “Unexecutable” volumes, do the following by referring to the Unexecutable Information.

Unexecutable Information	Measure
Have Unpaired	Execute it for a volume with the pair setting.
Foreground Copy State	Execute it for a volume in the Suspend state.
Separate State	Execute it for a volume in the Suspend state.
Freeze	Defreeze the Data Replication function and execute it again.
MV Monitoring Suspended	Change the disk array of MV to the Monitored state and execute it again.
RV Monitoring Suspended	Change the disk array of RV to the Monitored state and execute it again.
MV Force Unpaired	Perform Forced Unpair for RV.
RV Force Unpaired	Perform Forced Unpair for MV.
RV Forced Separate	Execute it for a volume in the Synchronous state.
MV Outside iSM Management	Execute it for a pair under the iSM management.
All Link Path Abnormal	Refer to 2.2.2 (2) "Link fault" in the "Data Replication User's Manual (Installation and Operation Guide for Windows)" to recover from the failure.
Have been registered to ATgroup	Execute it for a pair that is not registered in the AT-group.

(ii) Summary Display/Details Display

For more information on this item, refer to 3.2.6 "Information Displayed on Execution Dialog".

(iii) Copy Mode

You can specify the copy control state when copy is resumed.

The following copy modes can be specified.

Radio Button	Description
Synchronous	Changes the copy control state to the foreground copy (Synchronous) mode.
Semi-synchronous	Changes the copy control state to the foreground copy (Semi-synchronous) mode. This can be specified for pairs in different disk arrays.
Background Copy	Changes the copy control state to the Background Copy state.

When you click the [Execute] button, the following message is displayed.

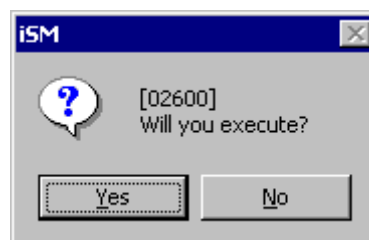


Figure 3-24 Confirmation Screen

[Execution Conditions]

To perform operations of suspending/resuming copy, the following conditions must be satisfied.

- (i) The target MV is recognized by Replication Management as the Replication target disk.
- (ii) The target MV and RV are paired.
- (iii) The activity state of the target pair is Replicate or Restore.
- (iv) The Semi-synchronous Copy mode cannot be specified for pairs set in the same disk array.
The Semi-synchronous Copy mode can be specified only for pairs set in different disk arrays. (Can be set only when copy is resumed.)
- (v) The disk array where the specified MV and RV are stored is not in the Freeze state.
- (vi) The disk array where the specified MV and RV are stored is monitored.
(In case of copy suspend, MV must be monitored)
- (vii) The specified MV is not registered in the AT-group.

Figure 3-25 illustrates the execution conditions of operations of suspending/resuming copy. (Each of (i) to (vii) in the figure corresponds to the respective number above.)

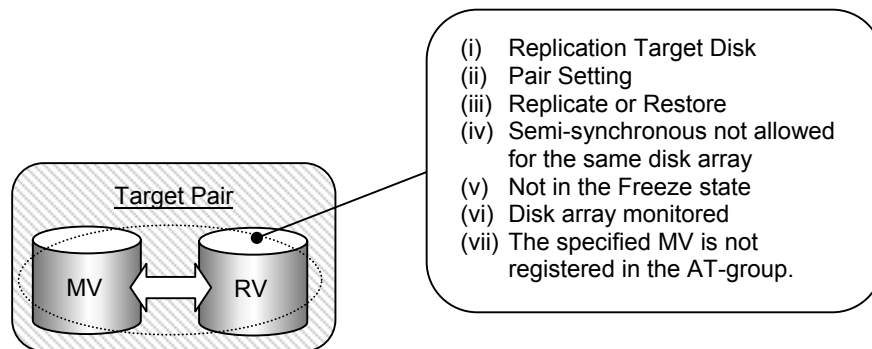


Figure 3-25 Execution Conditions of Suspend Copy and Resume Copy State Operation

3.3.6 Change to Background Copy

The copy control state is changed from the Replicate or Restore state to the Background Copy state.

[Operation Procedure]

Do one of the following to display the Change to Background Copy screen.

- Select a volume in the Replication Information screen, click [Operation] on the menu bar of the Replication screen, point to [Volume Operation], and then select [Change to Background Copy].
- Right-click in the Replication Information screen, point to [Volume Operation], and then select [Change to Background Copy].

Figure 3-26 shows an example of the Change to Background Copy screen.

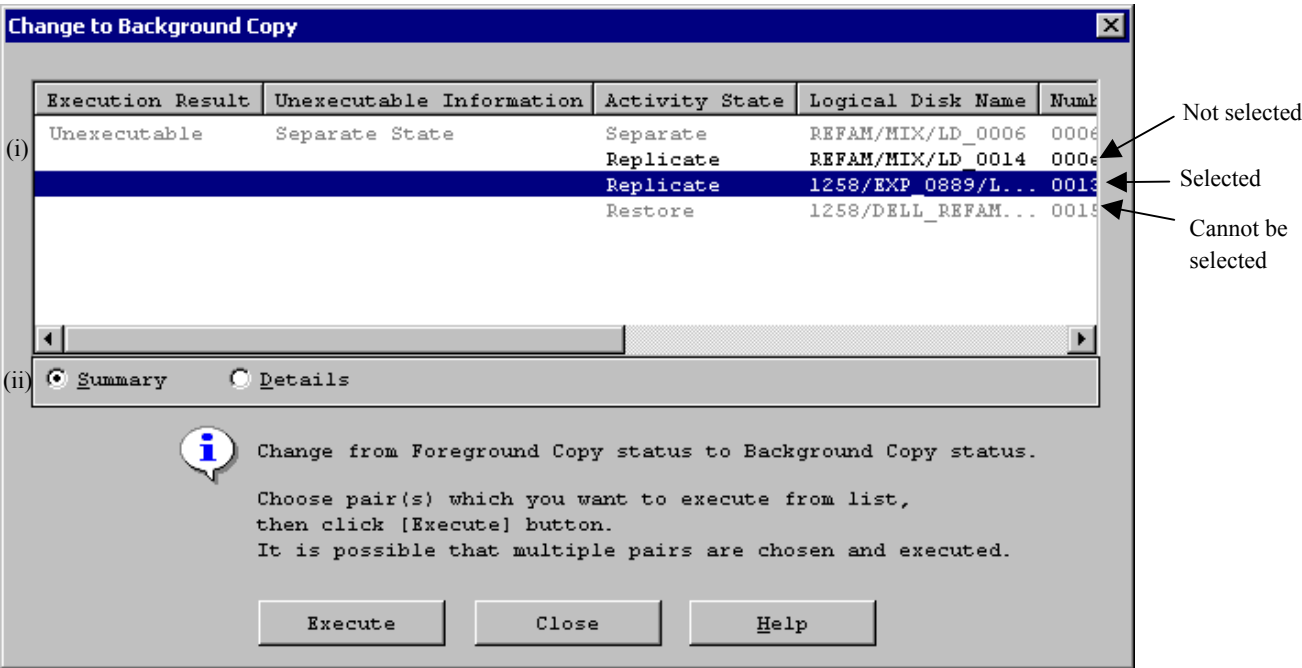


Figure 3-26 Example of Change to Background Copy Screen

From the list, select a pair for which you want to perform the operation, and then click the [Execute] button.

You can select multiple executable pairs and execute them in a batch.

Unexecutable pairs cannot be selected.

(i) Selected Volume List

Displays the list of the pair (MV/RV) information selected in the Replication Information screen.

Volumes whose Execution Result is “Unexecutable” cannot be selected because they do not satisfy the execution conditions.

For the “Unexecutable” volumes, do the following by referring to the Unexecutable Information.

Unexecutable Information	Measure
Have Unpaired	Execute it for a volume with the pair setting.
Separate State	Execute it for a volume in the Replicate state or Restore state.
Already Background Copy State	Execute it for a volume in Foreground Copy.
Freeze	Defreeze the Data Replication function and execute it again.
MV Monitoring Suspended	Change the disk array of MV to the Monitored state and execute it again.
RV Monitoring Suspended	Change the disk array of RV to the Monitored state and execute it again.
MV Force Unpaired	Perform Forced Unpair for RV.
RV Force Unpaired	Perform Forced Unpair for MV.
RV Forced Separate	Execute it for a volume in the Synchronous state.
MV Outside iSM Management	Execute it for a pair under the iSM management.
All Link Path Abnormal	Refer to 2.2.2 (2) "Link fault" in the "Data Replication User's Manual (Installation and Operation Guide for Windows)" to recover from the failure.
Have been registered to ATgroup	Execute it for a pair that is not registered in the AT-group.

(ii) Summary Display/Details Display

For more information on this item, refer to 3.2.6 "Information Displayed on Execution Dialog".

When you click the [Execute] button, the following message is displayed.

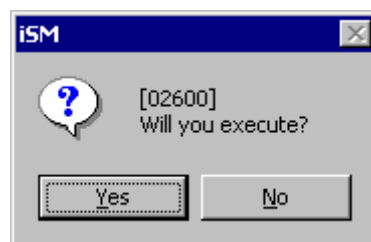


Figure 3-27 Confirmation Screen

[Execution Conditions]

To perform changes to Background Copy, the following conditions must be satisfied.

- (i) The target MV and RV are recognized by Replication Management as the Replication target disk.
- (ii) The target MV and RV are paired.
- (iii) The activity state of the target pair is Replicate or Restore.
- (iv) The disk array where the specified MV and RV are stored is not in the Freeze state.
- (v) The disk array where the specified MV and RV are stored is monitored.
- (vi) The specified MV is not registered in the AT-group.

Figure 3-28 illustrates the execution conditions of changes to Background Copy. (Each of (i) to (vi) in the figure corresponds to the respective number above.)

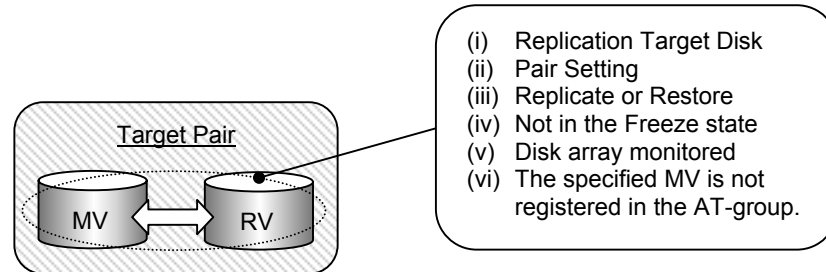


Figure 3-28 Execution Conditions of Change to Background Copy

3.3.7 RV Mode Change

You can change the RV access restriction.

[Operation Procedure]

Do one of the following to display the RV Mode Change screen.

- Select a volume in the Replication Information screen, click [Operation] on the menu bar of the Replication screen, point to [Volume Operation], and then select [RV Mode Change].
- Right-click in the Replication Information screen, point to [Volume Operation], and then select [RV Mode Change].

Figure 3-29 shows is an example of the RV Mode Change screen.

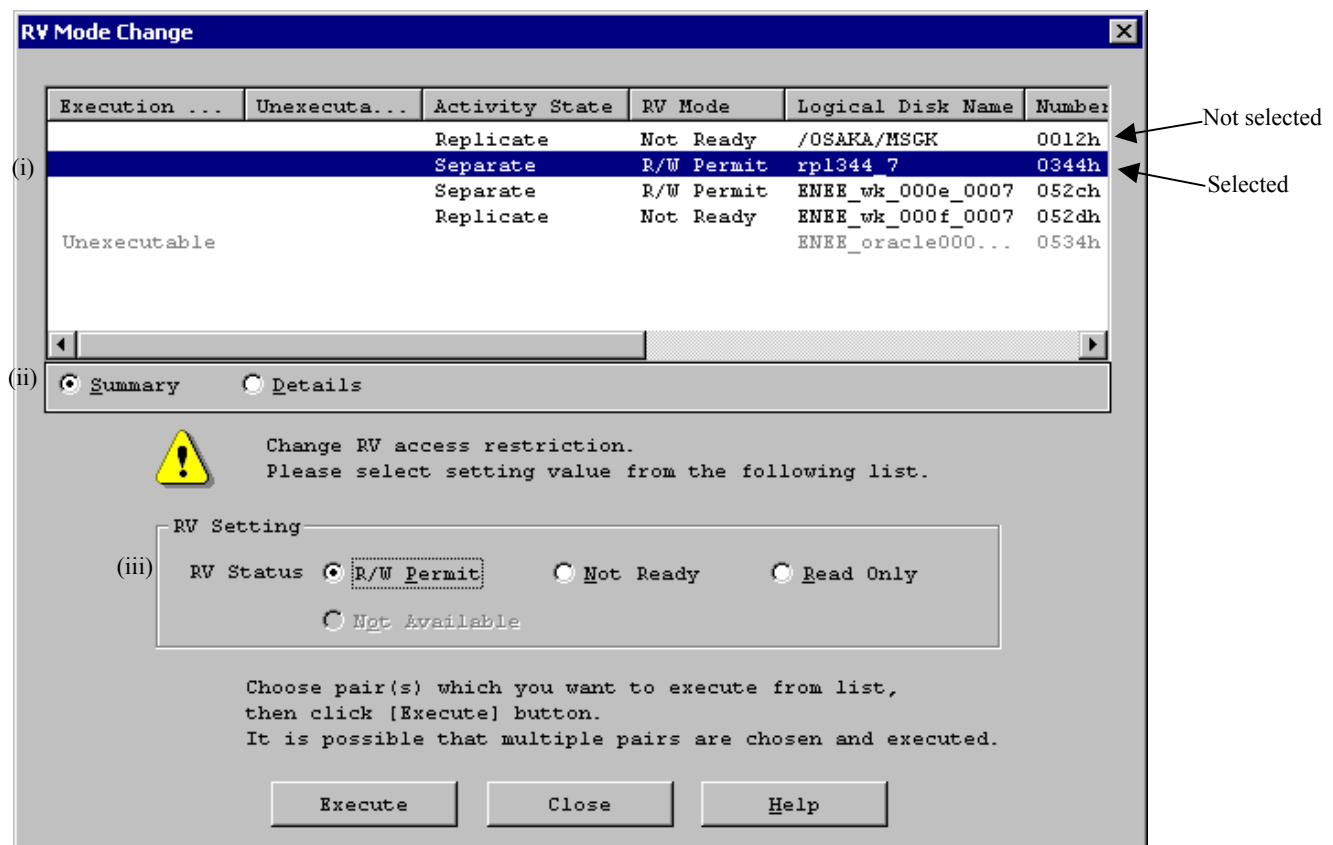


Figure 3-29 Example of RV Mode Change Screen

From the list, select a pair for which you want to perform the operation, and then click the [Execute] button.

You can select multiple executable pairs and execute them in a batch.

Unexecutable pairs cannot be selected.

(i) Selected Volume List

Displays the list of the pair (MV/RV) information selected in the Replication Information screen. Volumes whose Execution Result is “Unexecutable” cannot be selected because they do not satisfy the execution conditions.

For the “Unexecutable” volumes, do the following by referring to the Unexecutable Information.

Unexecutable Information	Measure
Have Unpaired	Execute it for a volume with the pair setting.
Freeze	Defreeze the Data Replication function and execute it again.
RV Outside iSM Management	Execute it for a pair under the iSM management.
RV Monitoring Suspended	Change the disk array of RV to the Monitored state and execute it again.
MV Force Unpaired	Perform Forced Unpair for RV.
RV Force Unpaired	Perform Forced Unpair for MV.
All Link Path Abnormal	Refer to 2.2.2 (2) “Link fault” in the “Data Replication User’s Manual (Installation and Operation Guide for Windows)” to recover from the failure.
Have been registered to ATgroup	Execute it for a pair that is not registered in the AT-group.

(ii) Summary Display/Details Display

For more information on this item, refer to 3.2.6 “Information Displayed on Execution Dialog”.

(iii) RV Status

Specifies the operations for a write request from the host.

Radio Button	Description
R/W Permit	Read and write can be performed for a volume from the host. * This cannot be executed in Replicate, Restore, or Separate execution (Refer to Figure 3-28 “Execution Conditions of Change to Background Copy”).
Not Ready	Operations for the volume cannot be performed from the host.
Read Only	For a volume, only read from the host can be performed. * Care should be taken to specify Read Only. Refer to 2.6 “RV Access Restriction”.
Not Available	For a volume, access from the host is disabled.

When you click the [Execute] button, the following message is displayed.

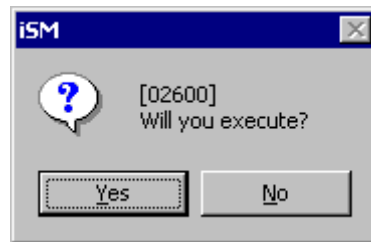


Figure 3-30 Confirmation Screen

When it is performed for a volume in Replicate, Restore, or Separate execution, the following warning message is displayed and the change of the RV mode of the volume is cancelled.

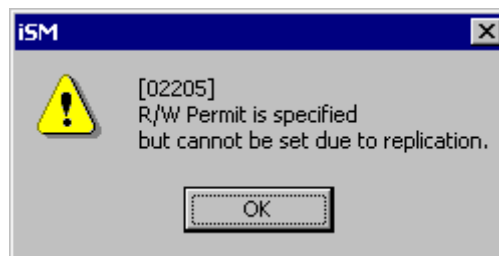


Figure 3-31 Warning Screen

[Execution Conditions]

To change the RV mode, the following conditions must be satisfied.

- (i) The target RV is recognized by Replication Management as the Replication target disk.
- (ii) The target MV and RV are paired.
- (iii) In the Separated state (when R/W Permit is specified).
- (iv) The disk array where the specified MV and RV are stored is not in the Freeze state.
- (v) The disk array where the specified RV is stored is monitored.
- (vi) The specified RV is not registered in the AT-group.

Figure 3-32 illustrates the execution conditions of change of the RV mode. (Each of (i) to (vi) in the figure corresponds to the respective number above.)

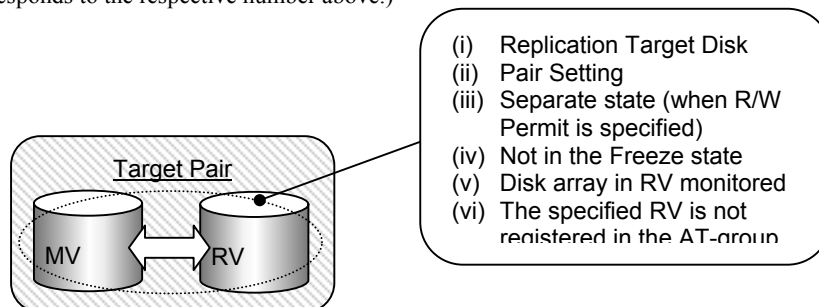


Figure 3-32 Execution Conditions of Change of RV Mode

3.3.8 Forced Separate

When a failure occurs in the connection between disk arrays and the normal Separate cannot be performed on MV and RV, you can use Forced Separate to instruct Separate to MV and RV individually.

Forced Separate forcibly separates MV and RV and makes RV available.

[Operation Procedure]

Do one of the following to display the Forced Separate screen.

- Select a volume in the Replication Information screen, click [Operation] on the menu bar of the Replication screen, point to [Forced Operation], and then select [Forced Separate].
- Right-click in the Replication Information screen, point to [Forced Operation], and then select [Forced Separate].

Figure 3-33 shows an example of the Forced Separate screen.

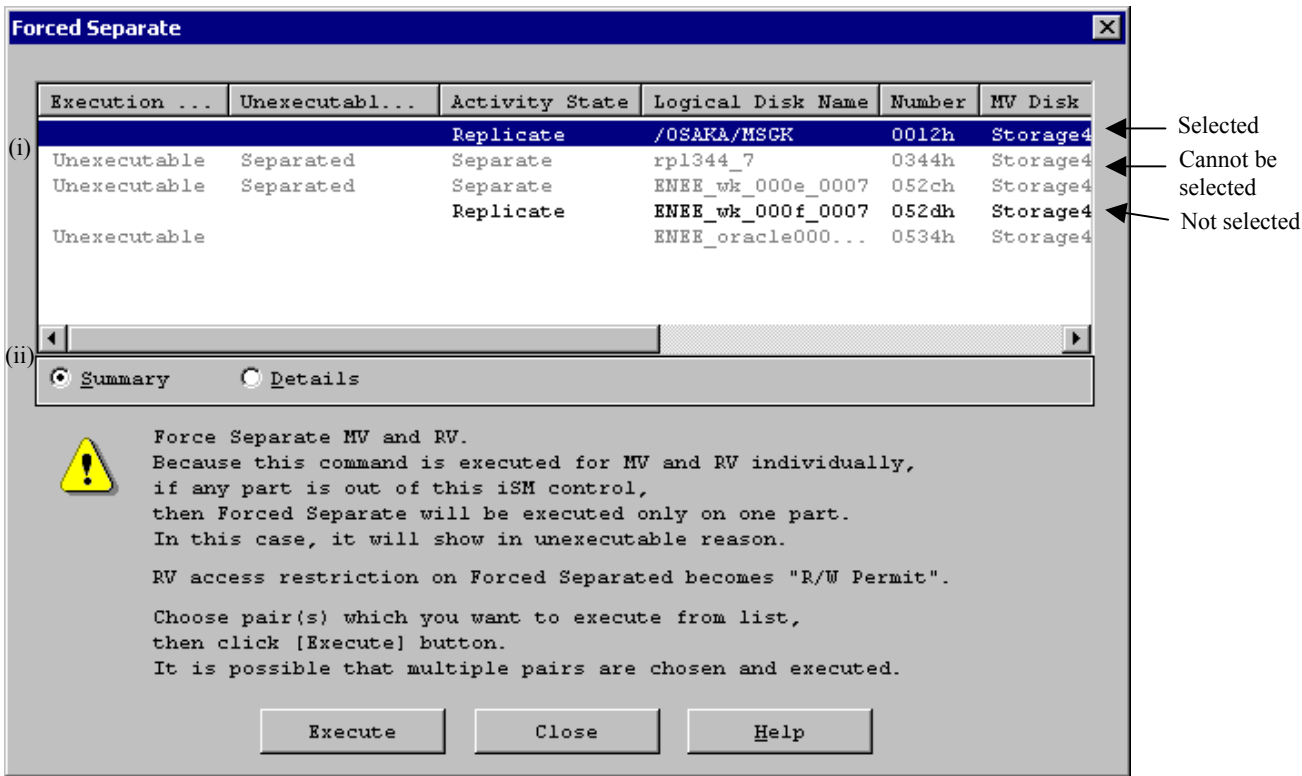


Figure 3-33 Example of Forced Separate Screen

From the list, select a pair for which you want to perform the operation, and then click the [Execute] button.

You can select multiple executable pairs and execute them in a batch.

Unexecutable pairs cannot be selected.

(i) Selected Volume List

Displays the list of the pair (MV/RV) information selected in the Replication Information screen. Volumes whose Execution Result is “Unexecutable” cannot be selected because they do not satisfy the execution conditions.

For the “Unexecutable” volumes, do the following by referring to the Unexecutable Information.

Unexecutable Information	Measure
Have Unpaired	Execute it for a volume with the pair setting.
Separated	Execute it for a volume in the Synchronous state.
MV Separated Complete	Execute it for a volume in the Synchronous state.
Forced Separation	Execute it for a volume in the Synchronous state.
MV Forced Separate	Execute it for a volume in the Synchronous state.
MV Fault	Refer to 2.2.2 “HW Fault Unique to Replication” in the “Data Replication User’s Manual (Installation and Operation Guide for Windows)” to recover from the failure.
MV Outside iSM Management	After execution of RV Forced Separate, perform Forced Separate for the volume in MV with the pair setting.
MV Monitoring Suspended	After execution of RV Forced Separate, perform Forced Separate for the volume in MV with the pair setting.
MV Freeze	After execution of RV Forced Separate, perform Forced Separate for the volume in MV with the pair setting.
MV Force Unpaired	Perform Forced Unpair for RV.
RV Separate Complete	Execute it for a volume in the Synchronous state.
RV Forced Separate	Execute it for a volume in the Synchronous state.
RV Outside iSM Management	After execution of MV Forced Separate, perform Forced Separate for the volume in RV with the pair setting.
RV Monitoring Suspended	After execution of MV Forced Separate, perform Forced Separate for the volume in RV with the pair setting.
RV Freeze	After execution of MV Forced Separate, perform Forced Separate for the volume in RV with the pair setting.
RV Force Unpaired	Perform Forced Unpair for MV.
Have been registered to ATgroup	Execute it for a volume that is not registered in the AT-group.

(ii) Summary Display/Details Display

For more information on this item, refer to 3.2.6 “Information Displayed on Execution Dialog”.

Figure 3-34 is displayed when MV is not under the iSM. Figure 3-35 is displayed when RV is not under the iSM.

After execution, perform Forced Separate for MV or RV not separated.

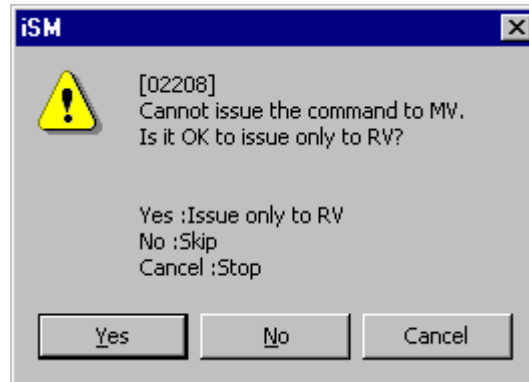


Figure 3-34 Warning Screen for MV without under iSM

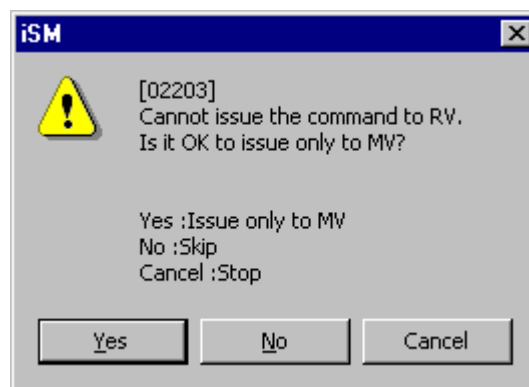


Figure 3-35 Warning Screen for RV without under iSM

When you click the [Yes] button, the following message is displayed.

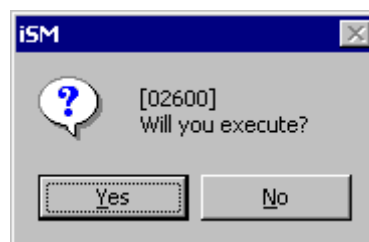


Figure 3-36 Confirmation Screen

[Execution Conditions]

To perform Forced Separate, the following conditions must be satisfied.

- (i) The target volume is recognized by Replication Management as the Replication target disk.
- (ii) The target MV and RV are paired, or one of them is forcibly separated.
- (iii) The disk array where the specified MV and RV are stored is not in the Freeze state.
- (iv) The disk array where the specified volume is stored is monitored.
- (v) The specified MV or RV is not registered in the AT-group.

Figure 3-37 illustrates the execution conditions of Forced Separate. (Each of (i) to (v) in the figure corresponds to the respective number above.)

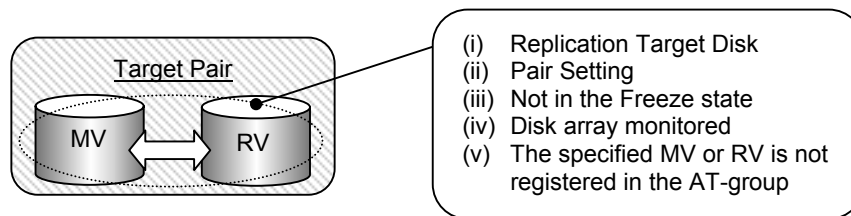


Figure 3-37 Execution Conditions of Forced Separate

3.3.9 Forced Unpair

When a failure occurs in the disk array of MV or RV, monitoring is suspended and the normal Cancel Pair may not be performed. In such a case, you can use Forced Unpair to unpair the pairs for MV and RV separately.

[Operation Procedure]

Before performing Forced Unpair, you must separate MV and RV with Separate or Forced Separate. Do one of the following to display the Forced Unpair screen.

- Select a volume in the Replication Information screen, click [Operation] on the menu bar of the Replication screen, point to [Forced Operation], and then select [Forced Unpair].
- Right-click in the Replication Information screen, point to [Forced Operation], and then select [Forced Unpair].

Figure 3-38 shows an example of the Forced Unpair screen.

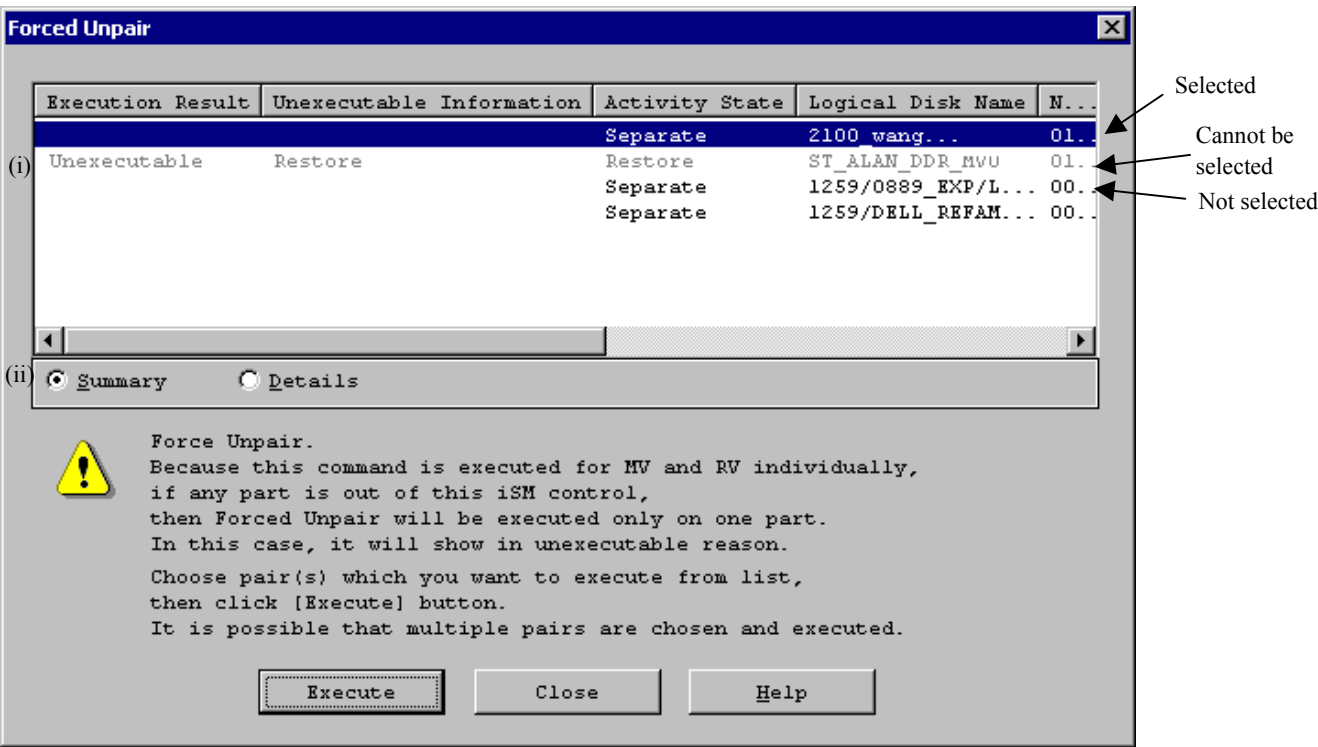


Figure 3-38 Example of Forced Unpair Screen

From the list, select a pair for which you want to perform the operation, and then click the [Execute] button.

You can select multiple executable pairs and execute them in a batch.

Unexecutable pairs cannot be selected.

(i) Selected Volume List

Displays the list of the pair (MV/RV) information selected in the Replication Information screen.

Volumes whose Execution Result is “Unexecutable” cannot be selected because they do not satisfy the execution conditions.

For the “Unexecutable” volumes, do the following by referring to the Unexecutable Information.

Unexecutable Information	Measure
Have Unpaired	Execute it for a volume with the pair setting.
Separating	Execute it again in the Separated state.
MV Separating	Execute it again in the Separated state.
Replicate	Execute it for a volume in the Separate state.
MV Replicate	Execute it for a volume in the Separate state.
Restore	Execute it for a volume in the Separate state.
MV Restore	Execute it for a volume in the Separate state.
MV Outside iSM Management	After execution of RV Forced Unpair, perform Forced unpair for the volume in MV with the pair setting.
MV Monitoring Suspended	After execution of RV Forced Unpair, perform Forced unpair for the volume in MV with the pair setting.
MV Freeze	After execution of RV Forced Unpair, perform Forced unpair for the volume in MV with the pair setting.
MV Force Unpaired	Perform Forced Unpair for RV.
RV Separating	Execute it again in the Separated state.
RV Replicate	Execute it for a volume in the Separate state.
RV Restore	Execute it for a volume in the Separate state.
RV Outside iSM Management	After execution of MV Forced Unpair, perform Forced unpair for the volume in RV with the pair setting.
RV Monitoring Suspended	After execution of MV Forced Unpair, perform Forced unpair for the volume in RV with the pair setting.
RV Freeze	After execution of MV Forced Unpair, perform Forced unpair for the volume in RV with the pair setting.
RV Force Unpaired	Perform Forced Unpair for MV.
Have been registered to ATgroup	Execute it for a volume that is not registered in the AT-group.

(ii) Summary Display/Details Display

For more information on this item, refer to 3.2.6 “Information Displayed on Execution Dialog”.



If Forced Unpair is performed for either MV or RV, the replication operations will not function properly because inconsistency occurs in the recognized states of MV and RV. In this case, perform Forced Unpair for MV or RV for which Unpair is not performed.

Figure 3-39 is displayed when MV is not under the iSM. Figure 3-40 is displayed when RV is not under the iSM.

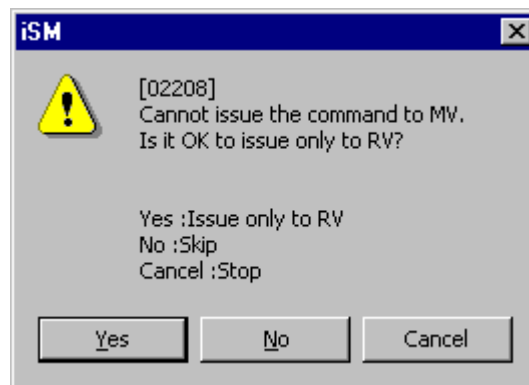


Figure 3-39 Warning Screen for MV without under iSM

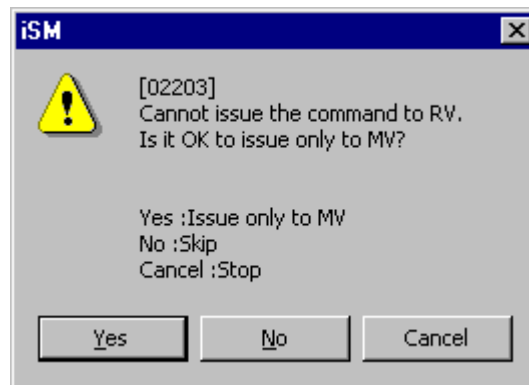


Figure 3-40 Warning Screen for RV without under iSM

When you click the [Yes] button, the following message is displayed.

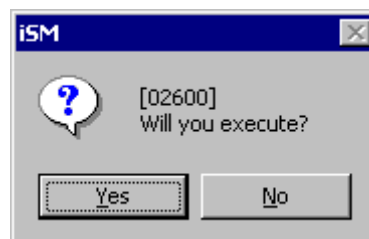


Figure 3-41 Confirmation Screen

[Execution Conditions]

To perform Forced Unpair, the following conditions must be satisfied.

- (i) The target volume is recognized by Replication Management as the Replication target disk.
- (ii) The target MV and RV are paired, or one of them is forcibly unpaired.
- (iii) The target pair is in the Separated or Forced Separate state.
- (iv) The disk array where the specified MV and RV are stored is not in the Freeze state.
- (v) The disk array where the specified volume is stored is monitored.
- (vi) The specified MV or RV is not registered in the AT-group.

Figure 3-42 shows the execution conditions for Forced Unpair. (Each of (i) to (vi) in this figure correspond to the respective number above.)

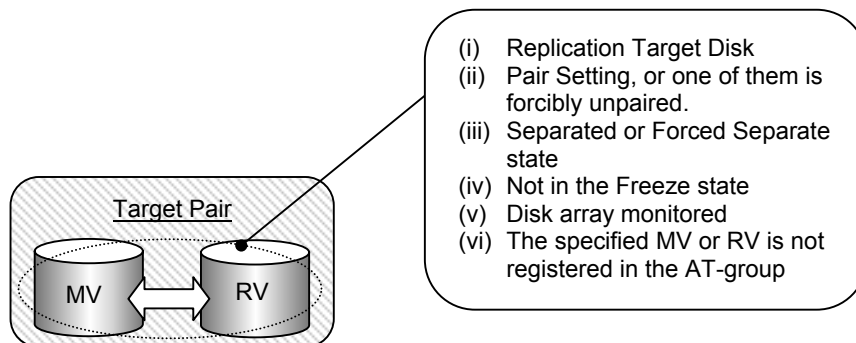


Figure 3-42 Execution Conditions of Forced Unpair

3.3.10 Freeze/Defreeze

You can freeze or defreeze the Data Replication function of the disk array.

[Operation Procedure]

Do one of the following to display the Freeze/Defreeze screen.

- Select the disk array in the configuration display area, click [Operation] on the menu bar of the Replication screen, point to [System Operation], and then select [Freeze/Defreeze].
- Select the disk array in the configuration display area, right-click it, and then select [Freeze/Defreeze].

Figure 3-43 shows an example of the Freeze/Defreeze screen.

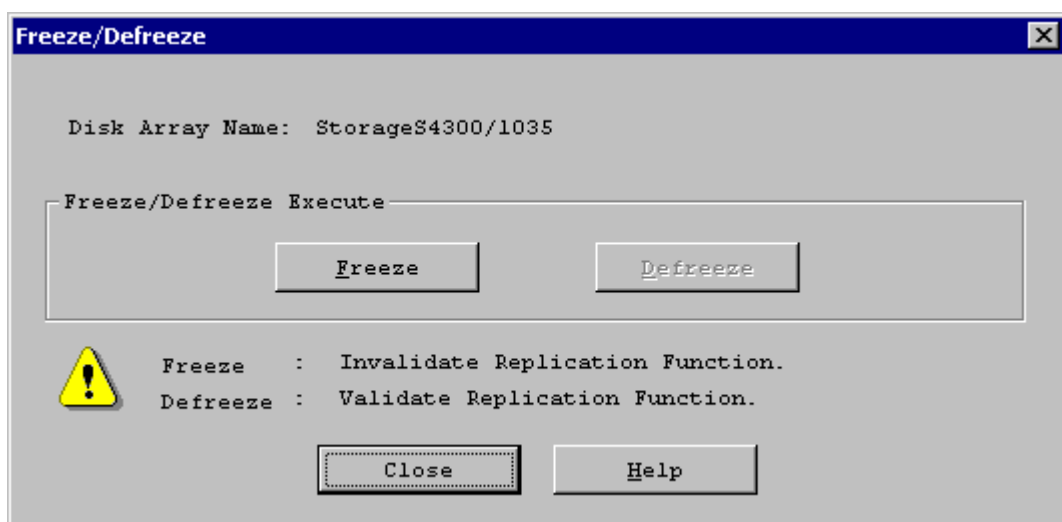


Figure 3-43 Example of Freeze/Defreeze Screen

(i) Freeze/Defreeze Execute

Button	Description
Freeze	Freezes (invalidates) the Data Replication function of the disk array.
Defreeze	Defreezes (validates) the Data Replication function of the disk array.

When you click the [Execute] button, the following message is displayed.

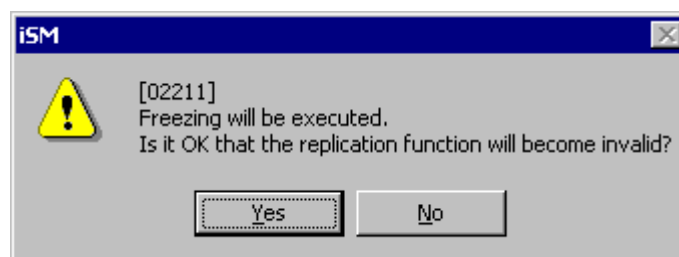


Figure 3-44 Confirmation Screen

[Execution Conditions]

To perform Freeze/Defreeze, the following conditions must be satisfied.

- (i) The target disk array is recognized by Replication Management.
- (ii) The specified disk array is monitored.

When you perform Freeze, no replication operations can be performed in the disk array. Refer to 2.8 “Freeze of Disk Arrays”.

3.3.11 Background Copy Level Change

You can change the priority of Background Copy of the disk array.

[Operation Procedure]

Do one of the following to display the Background Copy Level Change screen.

- Select the disk array in the configuration display area, click [Operation] on the menu bar of the Replication screen, point to [System Operation], and then select [Background Copy Level Change].
- Select the disk array in the configuration display area, right-click it, and then select [Background Copy Level Change].

Figure 3-45 shows an example of the Background Copy Level Change screen.

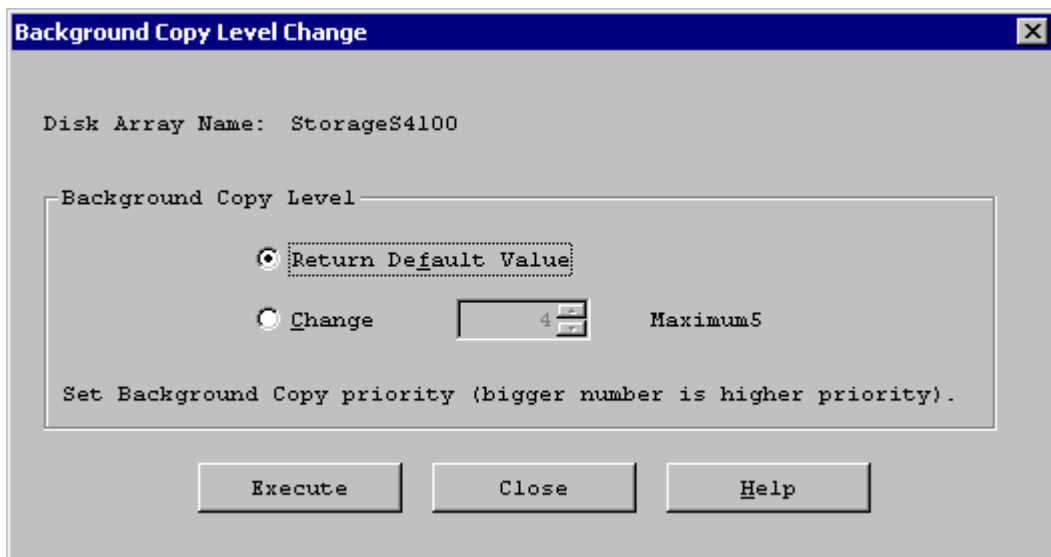


Figure 3-45 Example of Background Copy Level Change Screen

(i) Background Copy Level

Specifies the priority of copy operation when Background Copy is selected in Replicate and Restore.

A higher priority results in faster copying for reflecting difference. (For more information, refer to 2.4 “Copy Control State”.)

- Return Default Value

Restores the default value of the disk array.

- Change

You can specify the priority of the disk array.

When you click the [Execute] button, the following message is displayed.

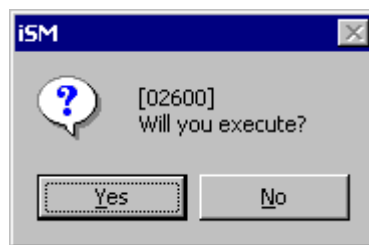


Figure 3-46 Confirmation Screen

[Execution Conditions]

To perform operations of the copy control state, the following conditions must be satisfied.

- (i) The target disk array is recognized by Replication Management.
- (ii) The specified disk array is monitored.

3.3.12 Connection Screen

The connection state of the volume is displayed.

[Operation Procedure]

Do one of the following to display the Volume Connection screen.

- Select a volume in the Replication Information screen, point to [View] on the menu bar of the Replication screen, and then select [Connection Screen].
- Select a volume in the Replication Information screen, right-click it, and then select [Connection Screen].
- Double-click a volume in the Replication Information screen.

Figure 3-47 shows an example of the Connection screen.

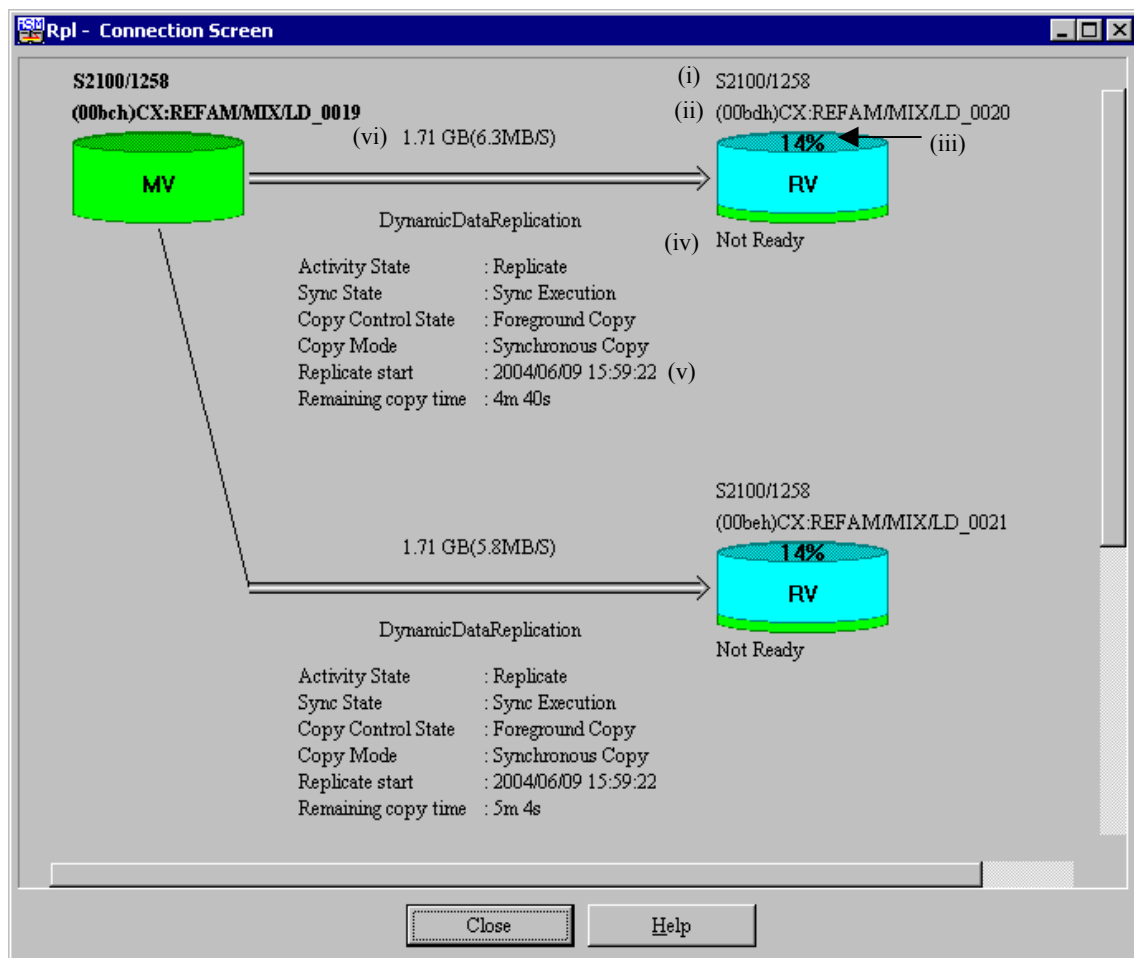


Figure 3-47 Example of Connection Screen

This screen displays the pair selected in the Replication Information screen. If two or more volumes are selected, all of them are displayed.

(i) Disk Array Name

Displays the name of the disk array where the volume exists.

The disk array name of the selected volume is highlighted.

(ii) Logical Disk Number, Format, Logical Disk Name

Displays them in the form of “(logical disk number) format:logical disk name (or VAA)”.

The logical disk number, format, and logical disk name of the selected volume is highlighted.

(iii) Copy Progress

Displays the progress of copy. This display disappears when copy is complete.

Progress may not change if I/O load is too heavy.

If a link failure occurs, Progress may not change. In this case, refer to 2.2.2 (2) “Link fault” in the “Data Replication User’s Manual (Installation and Operation Guide for Windows)”.

(iv) Access Restrictions for RV

Displays the access restrictions for RV. There are the following modes.

Mode	Description
R/W Permit	Read and write can be performed for a volume from the host.
Read Only	Only read can be performed for a volume from the host.
Not Ready	Operations for a volume cannot be operated from the host.
Not Available	Operations for a volume cannot be operated from any host.

(v) Operation Time Display

Displays the Start Time and End Time when operation for a volume is performed.

Displays the transition time at the forced separation or fault occurrence.

Displays the estimate of remaining time before copy completion during Replicate, Restore, or Separate. However, “-” is displayed for the time if the disk array to which MV belongs is not recognized by replication management.

* The time is displayed at the forced separation only on the RV side even if replication management does not recognize the disk array to which MV belongs.

Note: The estimate of remaining time may not be correct because it changes according to the monitoring timing, the units, the status of lines and so on.

(vi) Differential Quantity of Volume

Displays “remaining amount/transfer rate” during synchronization.

[Connection Display of Paired Volumes]

Connections of volumes are displayed as pipes as shown below.

During copy operation, the color of the original disk moves through the pipe.

- For DynamicDataReplication

Replicate is executed :



Replicate is complete :



Restore is executed :



Restore is complete :



Separate is executed :

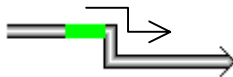


Separate is complete :



- For RemoteDataReplication

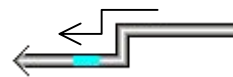
Replicate is executed :



Replicate is complete :



Restore is executed :



Restore is complete :



Separate is executed :

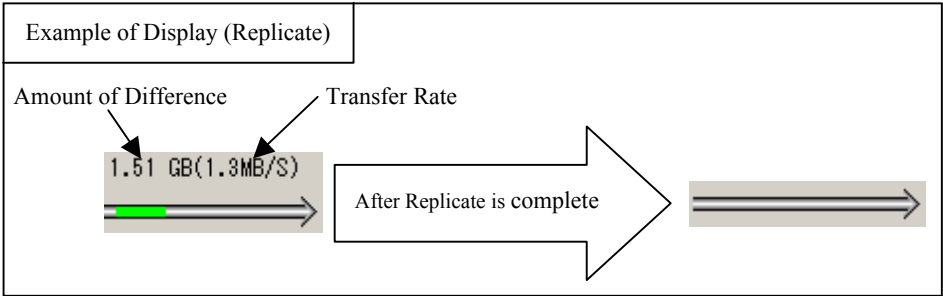


Separate is complete :



[Differential Quantity of Volume/Transfer Rate]

Displays the amount of difference and transfer rate during copy operation.
The unit of the amount of difference is variable (e.g. KB, MB, GB), and the unit of transfer rate is fixed (MB/S).



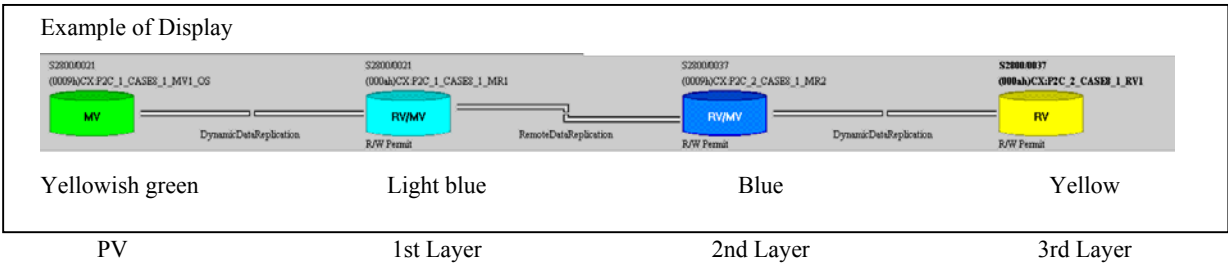
When Replication is complete (Amount of Difference=0), Amount of Difference and Transfer Rate (MB/S) disappears.

[Volume Color]

The Volume Color changes by layer and it becomes the layer color immediately after setting the pair or when Separate has completed.
When volume colors of the pair match, it indicates synchronization.

Layer color

- (i) PV: Yellowish green
- (ii) 1st Layer: Light blue
- (iii) 2nd Layer: Blue
- (iv) 3rd Layer: Yellow





In the pair connected by RemoteDataReplication, the remote disk array is not managed by iSM or, in a monitoring stop, may be displayed like the above.



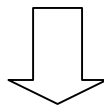
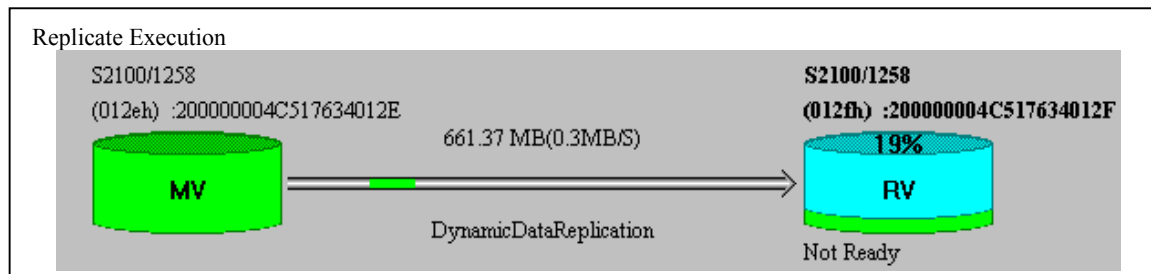
In the pair connected by RemoteDataReplication, when Remote Volume cannot be recognized from the host computer which Local Volume has connected by having performed Forced Unpair to Remote Volume etc., it may display like the above.

Case of the 2nd layer or more layer pair composition, when Forced Unpair is performed to the volume of the 1st layer or the 2nd layer, the volume of upper layers may not be displayed.

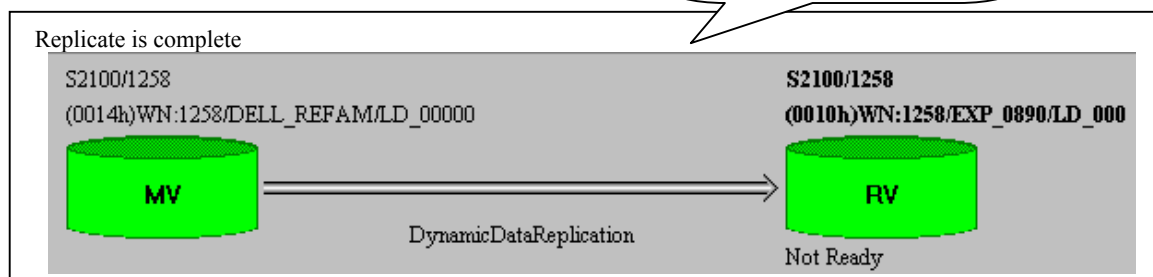
[Copy Progress]

Displays the progress of Replicate, Restore, etc. as the change in volume.

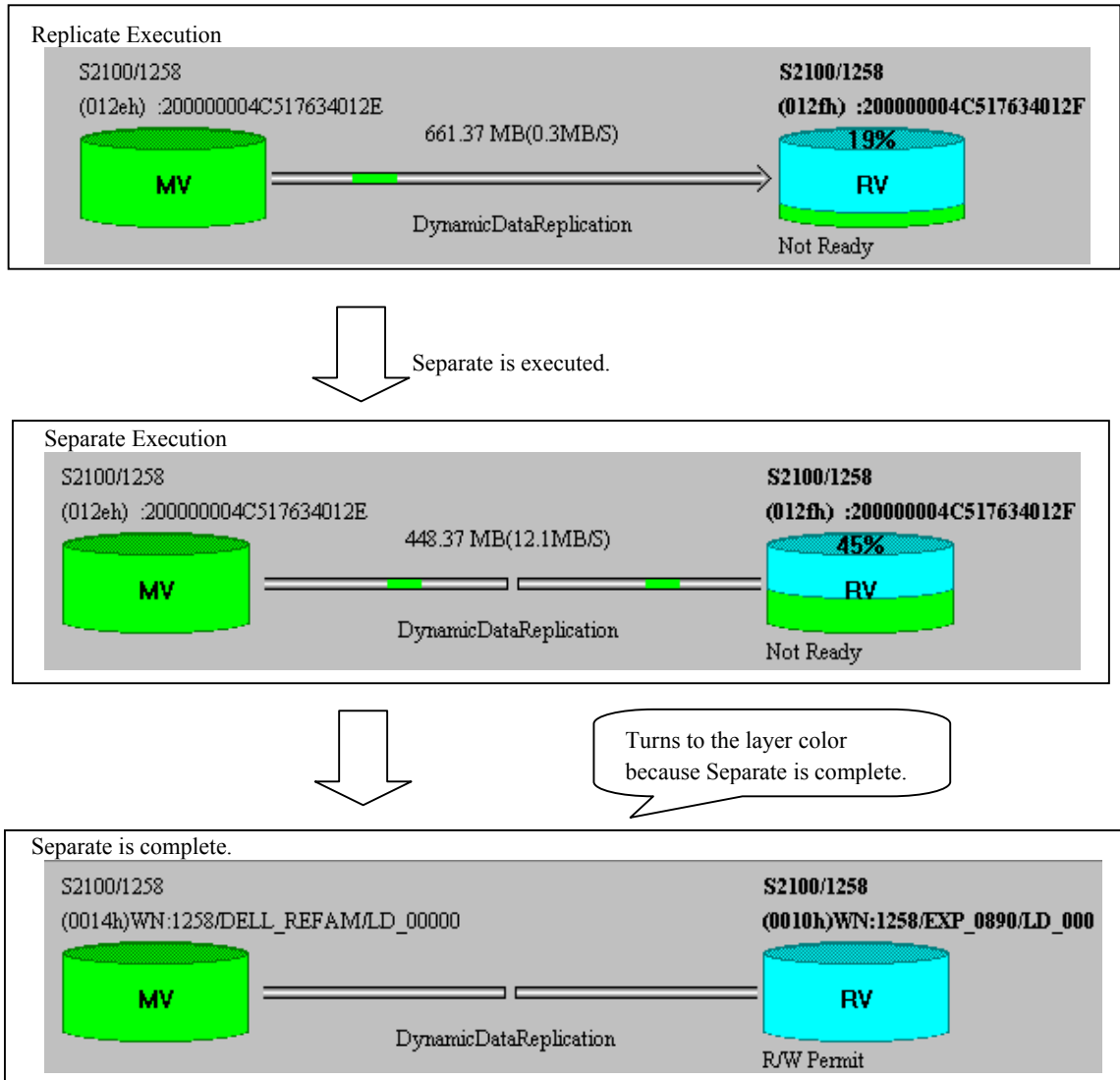
Example of Display 1: Replicate



Turns to the same color when synchronized.

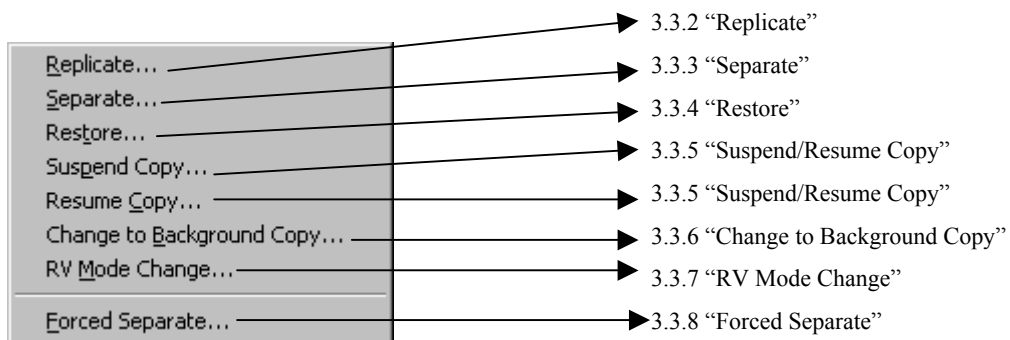


Example of Display 2: Separate during Replicate



[Others]

You can perform the replication operations by right-clicking the volume in the Connection screen. For how to operate, refer to the items in 3.3.



3.3.13 CSV Output of Information List Display

The replication information, the disk array LINK Information, and the AT-group information for the specified disk array can be output to a file in CSV format.

This CSV file can be used as a data for spreadsheet software.

On the menu bar, do the following:

- Click [File], and then click [CSV Output of Information List Display].

Figure 3-48 shows an example of the CSV Output of Information List Display screen.

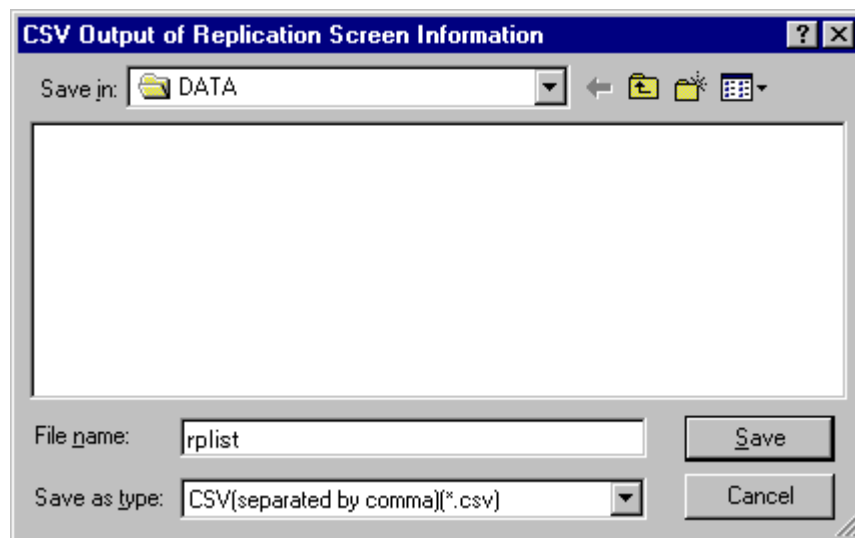


Figure 3-48 Example of CSV Output of Information List Display Screen

[CSV File Containing Information Display List]

This section shows an example of the CSV file that is created by executing the CSV output of information display list.

In this file, the information displayed on the screen is written in the format in which each item is separated by commas.

An example of the CSV file

Classification, Number, OS Type, Logical Disk Name, Pair Number, Paired Disk Name, Activity State, Disk Array, Sync State, Copy Control State, Copy Mode, RV Mode, Differential Quantity of Volume, Number of Pairs, Capacity [GB], LD Set name, ATgroup name

```
IV,0000h,WN,driveWN0,,,,,,,,,4.2,,
MV,0001h,WN,driveWN1,0001h,driveWN2,Replicate,Storage4300,Synchronized,Foreground
Copy,,,0 KB,1,4.2,WN:wos1,ATG0
RV,0002h,WN,driveWN2,0000h,driveWN1,Replicate,Storage4300,Synchronized,Foreground
Copy,Not Ready,,0 KB,1,4.2,,
MV,0003h,WN,driveWN3,0004h,driveWN4,Replicate,Storage4300,Synchronized,Foreground
Copy,,,3.7GB,1,4.2,,
RV,0004h,WN,driveWN4,0003h,driveWN3,Replicate,Storage4300,Synchronized,Foreground
Copy,Not Ready,,3.7 GB,1,4.2,,
IV,0005h,WN,driveWN5,,,,,,,,,4.2,WN:wos1,ATG1
IV,0006h,WN,driveWN6,,,,,,,,,4.2,WN:wos1,ATG2
MV,0007h,WN,driveWN7,0008h,driveWN8,Restore,Storage4300,Synchronized,Foreground
Copy,,,0 KB,1,4.2,,
RV,0008h,WN,driveWN8,0007h,driveWN7,Restore,Storage4300,Synchronized,Foreground
Copy,Not Ready,,0 KB,1,4.2,,
MV,0009h,WN,driveWN9,000ah,driveWNa,Separate,Storage4300,Forced Separation,,,0
KB,1,4.2,,
RV,000ah,WN,driveWNa,0009h,driveWN9,Separate,Storage4300,Forced Separation,,R/W
Permit,,0 KB,1,4.2,,
IV,000bh,WN,driveWNb,,,,,,,,,4.2,,
MV,000ch,WN,driveWNc,000dh,driveWNd,Separate,Storage4300,Separated,,,0
KB,1,4.2,WN:wos1,ATG3
RV,000dh,WN,driveWNd,000ch,driveWNc,Separate,Storage4300,Separated,,R/W Permit,,0
KB,1,4.2,,
```

3.3.14 Save Pair Setting Information

This function saves the pair setting information for the selected disk array to a file.

On the menu bar, do the following:

- Click [File], and then click [Save the Pair Setting Information].

Figure 3-49 shows an example of the Save Pair Setting Information screen.

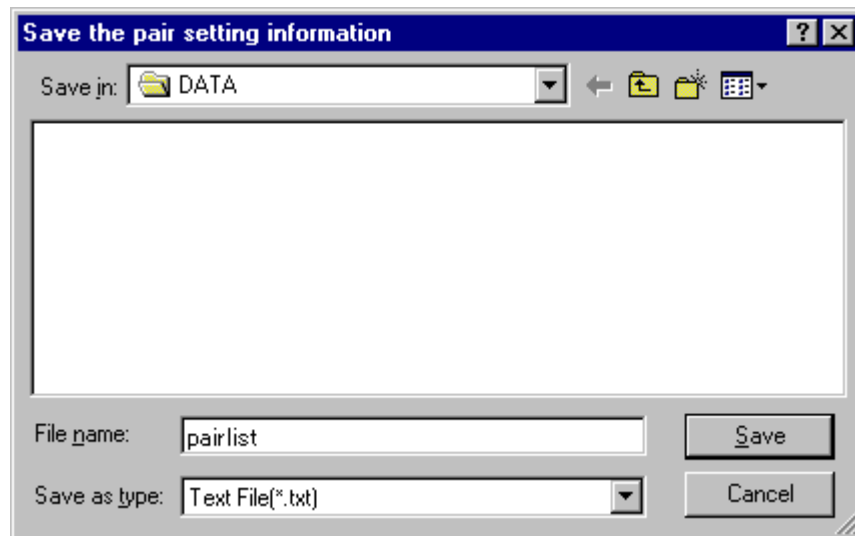


Figure 3-49 Example of Save Pair Setting Information Screen

A file that stores pair setting information can be used for “Replication Setting” of “New Setting” which is one of configuration setting functions. For details, refer to the “Configuration Setting Tool User’s Manual (GUI)”.

[Pair List]

This section describes the pair list that is output to a file by the replication management function.

- * The AT-group information can also be output to a CSV file. For details, refer to the “Data Replication User’s Manual (Disaster Recovery System Installation and Operation Guide)”.

Pair list format rules

- The file is a text file in the ASCII character format. (The default file name is pairlist.txt.)
- Text from a semicolon (;) or sharp (#) to the end of the line is regarded as a comment.
- There is a distinction between upper- and lower-case characters.
- Data is described in the following format.

```
“MV DiskArrayName”, “MV OSType”, “MV ExVolName”, “RV DiskArrayName”, “RV  
OSType”, “RV ExVolName”
```

Table 3-3 Pair List Format Rules

Item Number	Syntax	Description
1	Pair Name List	Identifier of this file. A space between characters is a half size.
2	MV DiskArrayName	Name of the disk array where the Master Volume (MV) belongs. The maximum number of characters is 32.
3	MV OSType	OS type of MV.
4	MV ExVolName	Logical disk name of MV The maximum number of characters is 24.
5	RV DiskArrayName	Name of the disk array where the Replication Volume (RV) belongs. The maximum number of characters is 32.
6	RV OSType	OS type of RV.
7	RV ExVolName	Logical disk name of RV The maximum number of characters is 24.
8	ATgroupName	AT-group name The maximum number of characters is 32.
9	DiskArrayName	Name of the disk array to which the AT-group belongs. The maximum number of characters is 32.
10	OSType	Usage type of the logical disk registered in the AT-group
11	ExVolName	Name of the logical disk registered in the AT-group The maximum number of characters is 24.

Example

Pair Name List

#iSM Ver.3.2.1 Tue Feb 24 20:42:35 2004

[Pair]

#MV DiskArrayName,MV OSType,MV ExVolName,RV DiskArrayName,RV OSType,RV
ExVolName

Storage4300/07,WN,ora45,Storage4300/10,WN,ora25

Storage4300/07,WN,ora46,Storage4300/10,WN,ora26

Storage4300/07,WN,ora47,Storage4300/07,WN,ora55

Storage4300/07,WN,ora48,Storage4300/07,WN,ora56

#<0000>

[atcreate]

#ATgroupName,DiskArrayName

ATG4300,Storage4300/07

[atadd]

#ATgroupName,OSType,ExVolName

ATG4300,WN,ora45

ATG4300,WN,ora46

3.3.15 Environment Setting

The interval to obtain disk array information is specified. It is the interval to obtain copy progress information in the screen display.

On the menu bar, do the following:

- Click [View], and then click [Environment Setting].

Figure 3-50 shows an example of the Environment Setting screen.

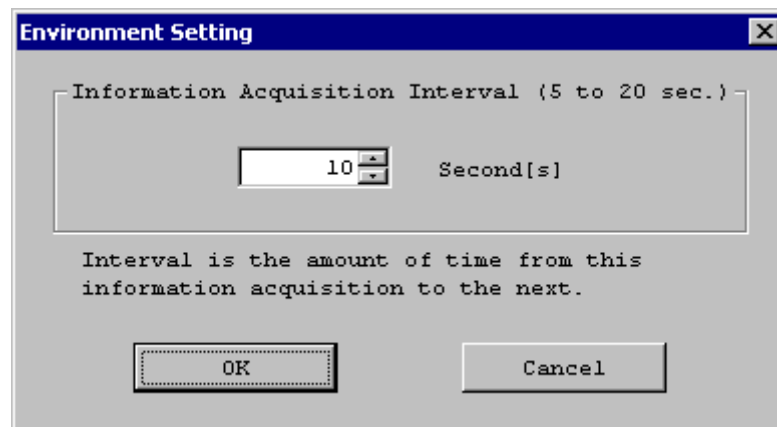


Figure 3-50 Example of Environment Setting Screen

The interval is the time interval after information is obtained until information is obtained next time. To reflect the settings to the Replicate Screen next displayed, perform Record Screen Information.

3.3.16 Refresh

While the iSM server in the upper-left part of the configuration display area is being selected, this function refreshes information of the disk array connected to the server. The information displayed on the screen is cleared.

While the Disk Array icon on the configuration display area is being selected, this function updates and redisplay the selected disk array and the list of volumes of the disk array linked to the selected disk array.

In any case, clicking the [Cancel] button before completing Update returns the screen to the state before update.

Do one of the following:

- Click [View] on the menu bar, and then select [Refresh].
- Press the F5 key.

When you perform [Refresh], the following message is displayed.

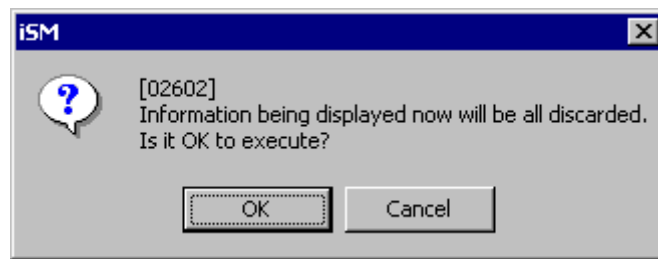


Figure 3-51 Warning Screen for Refresh

3.3.17 Record Screen Information

The screen information of Replication Screen is recorded.

The recorded information is reflected the next time the Replication Management screen is activated.

On the menu bar, do the following:

- Click [View], and then click [Record Screen Information].

[Recorded Items]

- Width of the item
- Location of the item
- Screen size
- Screen location
- IV display state
- Update interval of information
- Display state of the status bar
- Volume Connection screen location
- Connection screen size

3.3.18 Display Disk Array Properties

The setting states of the device are displayed.

Do the following:

- Select a disk array in the configuration display area, click [View] on the menu bar, and then select [Properties].
- Select a disk array in the configuration display area, right-click it, and then select [Properties].

Figure 3-52 shows an example of the Disk Array Properties screen.



Figure 3-52 Example of Disk Array Properties Screen

The items indicate the following information.

- Disk Array Name
Displays the identification information of the disk array.
- Differential Map
Displays whether the difference control function to keep track of the update difference status of MV and RV exists. If it is not installed, difference copy cannot be performed. (The copy range is always All.)

(iii) Replication Status

Indicates whether the Data Replication function of the disk array is available.

Display	Description
READY	Indicates that it is operable.
FREEZE	Indicates that the Data Replication function is frozen due to a power down process of the disk array or acceptance of a Freeze instruction.

(iv) Background Copy Level

Displays the priority of Background Copy.

(v) Maximum Number of RV Setting

Indicates the maximum number of RVs which can be set for one MV.

(vi) SAA (Subsystem Absolute Address)

Displays an address value, which can uniquely identify the disk array not overlapping with other disk arrays.

(vii) Maximum Number of Concentrator, Maximum Number of Volumes of One ATgroup, Maximum Number of Volume of All ATgroup

For details, refer to the “Data Replication User’s Manual (Disaster Recovery System Installation and Operation Guide)”.

3.3.19 Display Link Properties

The link states are displayed.

Do one the following:

- Select an item in the Disk Array LINK Information screen, click [View] on the menu bar, and then select [Properties].
- Select an item in the Disk Array LINK Information screen, right-click it, and then select [Properties].

Figure 3-53 shows an example of the Link Properties screen.



Figure 3-53 Example of Link Properties Screen

The items indicate the following information (Refer to Figure 3-5 “Replication Link Information”).

- (i) Link Disk Array Name
Indicates the identification name assigned to the linked disk array.
- (ii) Path Number
Indicates the link path number of the selected link information.
- (iii) Director Number
Indicates the replication director (host director for the 2400 and 2800 series) number of the selected link information.
- (iv) Port Number
Indicates the port number of the replication director (host director for the 2400 and 2800 series).
- (v) Replication Port N Port Identifier Lock
Indicates whether the port ID of the target is variable or fixed.

Display	Description
00h	Variable value depending on the system configuration
01h	Fixed value

- (vi) Replication Port N Port Identifier
Indicates the port ID of the target.

(vii) Path State

Display	Description
Normal	Indicates the normal status.
Offline	Indicates that the link setting is unconfirmed during startup of the disk array.
Freeze	Indicates that the Data Replication function in the target disk array is frozen.
Link Checking	Indicates that the link status is being checked due to a failure of communication in the link.
Fault	Indicates that the link is invalid due to a failure of communication in the link.
Not Clear	Indicates the state other than the above.

3.3.20 Display Copy Fault List

The copy fault list displays the pairs where a copy fault occurred.

When a copy fault occurs, do the following to recover from the fault.

- * The pair registered in AT-group cannot be recovered from the copy fault list screen.
- * Unless you have acquired the volume information of the disk array that has a copy fault, no faults are displayed on the copy fault list screen. You must acquire the volume information of the disk array that has a copy fault. For the procedure for acquiring the volume information, refer to 3.2.3 “Replication Information Screen”.

On the menu bar, do the following:

- Click [View], and then click [Copy Fault List].

Figure 3-54 shows an example of the Copy Fault List screen.

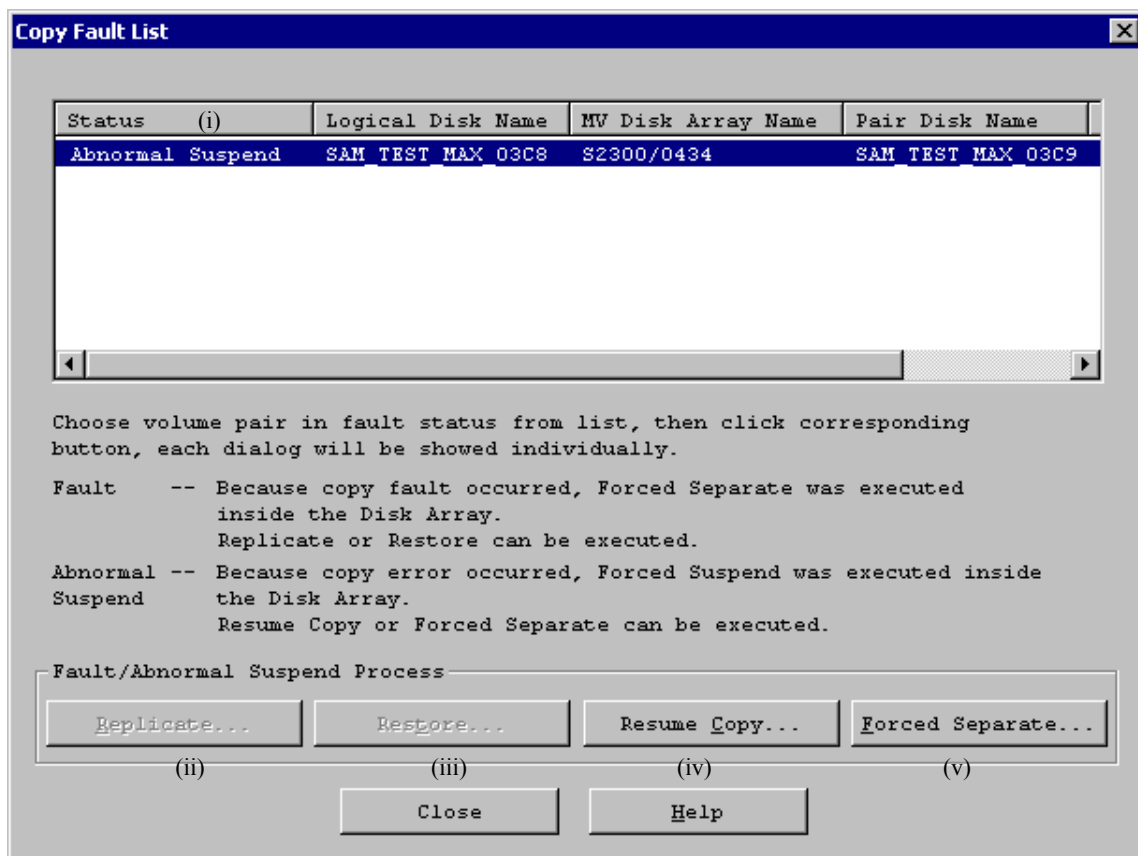


Figure 3-54 Example of Copy Fault List Screen

When you select a volume of the failure pair from the list and click one of the buttons, the corresponding dialog box appears.

(i) Status

Status	Description
Fault	Forcefully separated in the disk array due to a copy fault.
Abnormal Suspend	Forcefully suspended in the disk array due to a copy fault.

(ii) Replicate

Performs Replicate for the selected pair.

This operation can be performed for a volume in the Fault state.

(iii) Restore

Performs Restore for the selected pair.

This operation can be performed for a volume in the Fault state.

(iv) Resume Copy

Performs Resume Copy for the selected pair.

This operation can be performed for a volume in the Abnormal suspend state.

(v) Forced Separate

Performs Forced Separate for the selected pair.

This operation can be performed for a volume in the Abnormal suspend state.

Chapter 4 Functions of ReplicationControl

This chapter describes how to operate functions of the ReplicationControl that runs on the business server. The ReplicationControl functions include the creation and display of the volume list, replication operations, pair operations, and disk operations that are necessary for operating MV's and RV's in the system.

The description of "UNIX" in this chapter includes all of the UNIX systems supported by the ReplicationControl, such as HP-UX, Solaris, and so on.

4.1 Command List

Table 4-1 shows the commands of the ReplicationControl.

For details of each command, refer to the “Data Replication Command Reference”.

Table 4-1 The List of ReplicationControl Commands

Command Name	Operation	Description	Target System	
			Windows	UNIX
iSMvollist	Volume List Creation/Display	Associates logical disk (disk array side) information with system dependent information (server side) and displays the associated information.	○	○
iSMrc_replicate	Replicate	Starts Copy (Replicate) from MV to RV.	○	○
iSMrc_separate	Separate	Separate RV from MV in the Synchronous state (Replicate or Restore).	○	○
iSMrc_restore	Restore	Starts Copy (Restore) from RV to MV.	○	○
iSMrc_change	Change Copy Control State	Performs Copy Control State change when copying data from MV to RV.	○	○
iSMrc_wait	Wait for state	Waits for Synchronous State (rpl/sync), Synchronous State (rst/sync), or Separated state.	○	○
iSMrc_query	Paired Volume State Display	Displays the Copy state of a pair.	○	○
iSMrc_sense	Volume List Display	Displays volume information.	○	○
iSMrc_ldlist	Logical disk information display	Obtains and displays logical disk list information.	○	○
iSMrc_pair	Pair Setting and Unpair	Sets and unpairs paired volumes.	○	○
iSMrc_arrayinfo	Disk array information display	Displays information on the replication function of a disk array.	○	○
iSMrc_flush	File system buffer flush	Flushes the file system cache buffer.	○	—
iSMrc_mount	Volume Mount	Mounts a volume (file system).	○	—
iSMrc_umount	Volume Unmount	Unmounts a volume (file system).	○	—
iSMrc_signature	Signature Operation	Performs operation regarding the signature of each disk.	○	—
iSMrc_scan	Disk scanning	Scans for detecting available disks.	○	—

○: Targeted —: Not targeted

Notes:

1. On the Windows system, operations are allowable only for a user who belongs to the Administrators group.
2. On the UNIX system, operation authority is given to a super user immediately after the installation. The volume list can be created only by the super user; other operations, however, can be performed by anybody by changing the authority to access commands and directory operations.

4.2 Operation Types

To use ReplicationControl, the following operations can be selected.

- Direct operation for a disk array

This operation performs via FC directly a volume (MV or RV) connected to the server and recognized by OS. This operation type is the most basic type when replication operation is performed by a business server.

It is possible for the user to prepare a volume (IV is recommended) that can issue an I/O securely to a disk array and operate it through the specific volume (control volume). The operation through the control volume is effective especially in the backup server environment where even if the target volume (RV) is connected, OS cannot access the volume by the replication operation and the like.

For the direct operation for a disk array, the logical disk of the target MV or RV needs to be registered in the volume list in advance on the server where commands for the replication operation are executed.

For details, refer to 4.2.1 “Direct Operation for a Disk Array”.

- Operations linked with the iSM (replication management function)

Installing ReplicationControl in the management server and linking it with the replication management function of the iSM for operations enable you to manage and maintain the data replication function and to construct the environment by commands.

The logical disk to be operated does not need to be connected to the server. Therefore, you do not need to create the volume list.

Commands to create and display the volume list and commands to manage and operate disks, such as to flush, mount, and unmount a file system, are functions to operate volumes of the system directly.

They are not used for operations linked with the iSM.

For details, refer to 4.2.2 “Operations Linked with iSM”.

Table 4-2 Operation Form

Command Name	Operation	Direct Operation of Disk Array	Operation Linked with iSM
iSMvollist	Volume List Creation/Display	○	—
iSMrc_replicate	Replicate	○ ^{*1}	○
iSMrc_separate	Separate	○ ^{*1}	○
iSMrc_restore	Restore	○ ^{*1}	○
iSMrc_change	Change Copy Control State	○ ^{*1}	○
iSMrc_wait	Wait for state	○	○
iSMrc_query	Paired Volume State Display	○	○
iSMrc_sense	Volume List Display	○	○
iSMrc_ldlist	Logical disk information display	○	○
iSMrc_pair	Pair Setting and Unpair	○ ^{*1}	○
iSMrc_arrayinfo	Disk array information display	○	○
iSMrc_flush	File system buffer flush	○ ^{*2}	—
iSMrc_mount	Volume Mount	○ ^{*2}	—
iSMrc_umount	Volume Unmount	○ ^{*2}	—
iSMrc_signature	Signature Operation	○ ^{*2}	—
iSMrc_scan	Disk scanning	○ ^{*2}	—

—: Not targeted ○: Available

*1 If the control volume is not used, the operation is available when a volume on the MV is recognized by the server (OS) and accessible to the MV.

*2 Only the volume of the system recognized by the server can be operated.

4.2.1 Direct Operation for a Disk Array

For direct operation for a disk array, you can select one of the following configurations for each server.

- Direct operation is the most basic operation when the replication operation is performed from a business server.

The MV used for operations is connected to a business server, and the RV used for backup and the like is connected to a backup server or others. To perform direct operation, you need to register the logical disk that is recognized by a server (OS) and can be accessed in the volume list on each server.

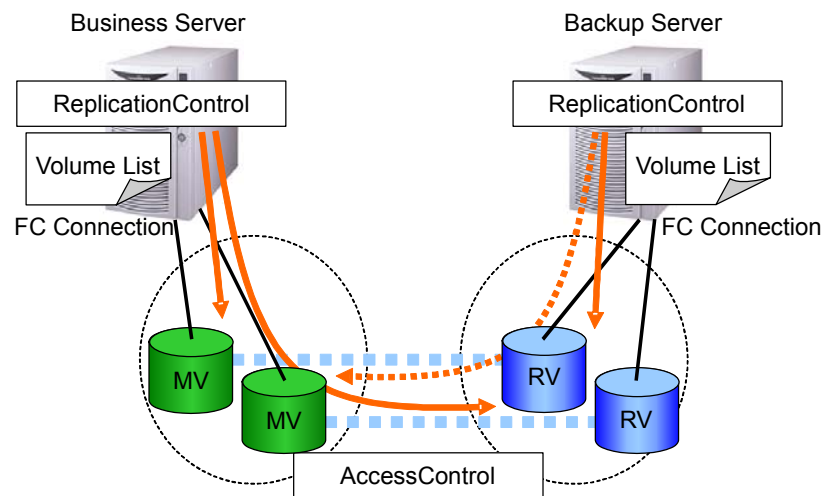


Figure 4-1 Direct Operation to MV or RV Volumes

- A volume (control volume) is prepared to issue an I/O to a disk array, and operation is performed through the control volume.

Since operation is performed through the control volume, a business server or a backup server can operate MV or RV even though those servers cannot access MV or RV directly. Depending on the Access Control setting of the disk array, however, operation can be performed only to the logical disk permitted to access the server or the logical disk that pairs with a logical disk permitted to access the server.

Select a logical disk for each disk array from logical disks connected to each server as a control volume, and define it as the volume used to issue an I/O to a disk array beforehand to register it in the volume list.

Defining a control volume in the volume list in advance eliminates the need for considering the existence of a control volume during operation. If a control volume has been defined, an I/O is issued to a disk array using the control volume automatically.

For details on the definition of a control volume, refer to the “Data Replication User’s Manual (Installation and Operation Guide for Windows)” of systems to be used.

The business server to which MV is connected can operate MV directly, and no control volume is needed normally. The backup server to which RV is connected can perform operations, such as replication or separation, if a control volume is prepared.

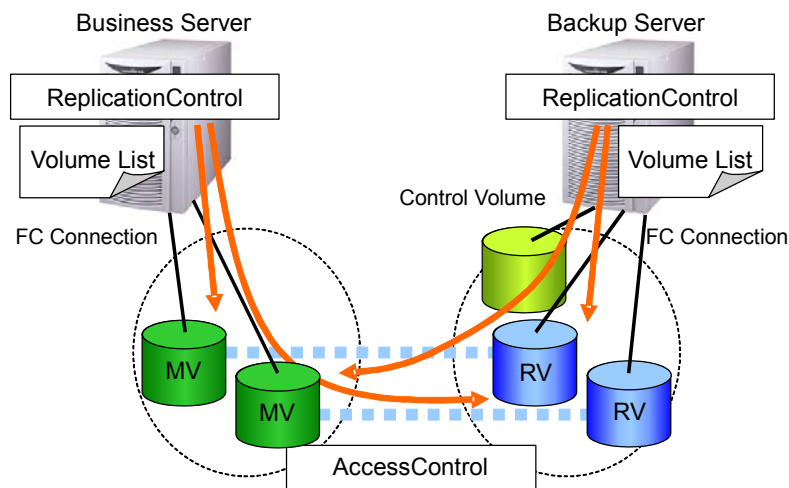


Figure 4-2 Operation Using a Control Volume

In the ReplicationControl environment setting, you need to set DIRECT (issue an I/O to a disk array directly) for I/O issuing path to a disk array.

For details on environment setting, refer to Chapter 3 “Operation Settings” in the “Data Replication Command Reference”.

[Notes on Operation]

Take notes on the following for direct operation to a disk array.

- Set Access Control using the AccessControl function correctly to the logical disk of paired MV or RV to be operated and the logical disk used as a control volume, and then connect the logical disks to each server. Prior to the replication operation on each server, create the volume list and register the logical disks to be operated in the volume list in advance.
- When you use a control volume, prepare a control volume for each server. It is not recommended that the same logical disk should be used as a control volume from multiple servers.
- The RAID format and capacity are not limited for the logical disk used as a control volume. For the disk arrays with pool, a logical disk with small capacity can be constructed for a control volume. For constructing a control volume, refer to the “Configuration Setting Tool User’s Manual (GUI)”.
- When you define or change a control volume, you need to update the volume list. When you add or delete a disk array, reconstruct a logical disk or change its setting, or add or delete a logical disk that can be accessed from a server, be sure to update the volume list to the latest state.

4.2.2 Operations Linked with iSM

Operating ReplicationControl together with the replication management function of the iSM enables you to operate and maintain the data replication function, and to construct the environment, such as pairing and unpairing by commands, which have been conventionally conducted by the client of the iSM through GUI.

You do not need to connect the logical disk to be operated to the server and to register the logical disk in the volume list. Therefore, to link with the iSM for operation, you do not need to create the volume list.

To conduct a joint operation with the iSM, install the ReplicationControl on the server on which the iSM has been installed and is operating. When you conduct ReplicationControl environment setting, select MANAGER (issuing an I/O to a disk array via the iSM) for the setting of I/O issuing path to the disk array. For details of the environment setting, refer to Chapter 3 “Operation Settings” in the “Data Replication Command Reference”.

Operations linked with the iSM have the following advantages.

- You can use commands for managing and maintaining the operations of the data replication function and operating environment construction.
- The logical disk to be operated does not need to be connected to a server. You can operate all the logical disks in the disk array to be monitored by the iSM.
- Since operation is performed through the iSM, connection to the disk array and issuing an I/O to the disk array can be performed through LAN.

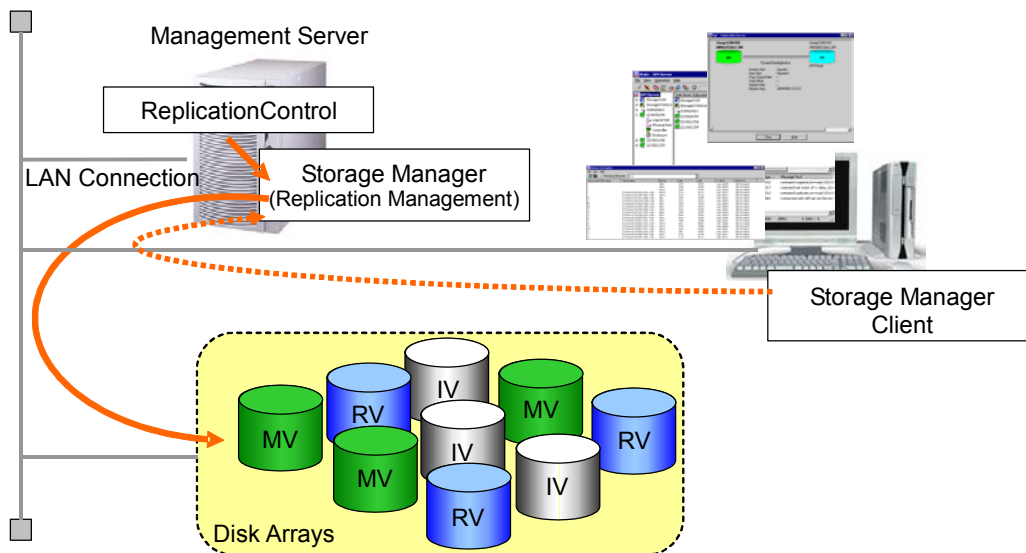


Figure 4-3 Operation Linked with iSM

[Notes on Operation]

For operations linked with the iSM, pay attention to the following.

- In the operations linked with the iSM, replication is operated in the asynchronous state with operations. To perform replication operation linked with operations, be sure to install ReplicationControl on each server and perform operation linked with operations of each server because operation of a file system needs to be performed on the business server and the backup server and data consistency needs to be secured.
- To perform replication and pairing, the state monitoring information of the disk array held by the iSM needs to be in the latest state. Therefore, set a short update time interval of the state monitoring information held by the iSM or update the information of the disk array and logical disk for operation using the -cr option of the iSMrc_ldlist command. For how to specify the environment settings, such as update time interval of state monitoring information held by the iSM, refer to the “User’s Manual” or the “User’s Manual (UNIX)”.

4.3 Volume Types

Types of volumes that are specified as operation targets for data replication commands are as follows:

Table 4-3 shows the list of volume types.

Table 4-3 List of Volume Types

Type	Description	Identifier	Target System	
			Windows	UNIX
Logical disk name	Specifies a logical disk name set on the disk array side.	ld	○	○
Mount point volume name	Specifies a mount point volume name assigned to the volume by the system.	mvol	○	—
NTFS folder name	Specifies an NTFS folder name (path name) for the volume.	mdir	○	—
Drive letter	Specifies a drive letter for the volume.	drv	○	—
Special file name	Specifies a special file name assigned to the disk (logical disk) by the system.	sfn	—	○
Volume group name	Specifies a name of the LVM's volume group that includes the disk (logical disk).	vg	—	○
Disk group name	Specifies a name of the VxVM's disk group that includes the disk (logical disk).	dg	—	○

○: Targeted

—: Not Targeted

Notes:

- The identifier is a character string that indicates the volume type and is used in the following cases:
 - When specifying a volume type by a replication operation command option (-mvflg, -rvflg, or -volflg)
 - When specifying a volume type by a pair specification (MV type or RV type) in the replication operation file
- To use the volume group, the LVM environment is necessary.
- To use the disk group, the VxVM environment is necessary.
- On the UNIX system Solaris version, to specify a special file name (/dev/rdisk/c##t##d##s#), remove the special file name's slice (partition) number (s#).
- The pair setting and unpairing operation (iSMrc_pair command) is performed on a single logical disk; therefore, it is not possible to specify an LVM volume group or a VxVM disk group.
- To conduct joint operation with the replication management (controlling the I/O issuance to disk arrays via the iSM), an applicable volume type is a logical disk name only.

4.4 Replication Operation File

To perform the batch setting of multiple pairs by executing replication and pair operation commands, or to execute multiple commands for a specific pair, use the replication operation file. Using the replication operation file allows operation target pairs to be described in the file, managed and shared, thereby improving system operations and maintenance performance of the data replication.

The following example shows a description in the replication operation file:

- Example for the Windows system

```
#Type:MV                                Type:RV
ld:dev000                                ld:dev001
drv:E                                    drv:F
ld:dev006                                drv:G
drv:H                                    ld:dev007

# Parallel configuration
ld:dev002                                ld:dev003
ld:dev002                                ld:dev004

# MV:RV=1:1
ld:dev005
```

- Example for the UNIX system

```
#Type:MV                                Type:RV
sfn:/dev/rdisk/c16t1d0                  sfn:/dev/rdisk/c16t1d1
sfn:/dev/rdisk/c16t1d2                  sfn:/dev/rdisk/c16t1d3
vg:/dev/vgvol                           ld:/dev/rdisk/c16t1d4,/dev/rdisk/c16t1d5
dg:dg_name
ld:dev001                                ld:dev002
ld:dev003                                sfn:/dev/rdisk/c23t2d0

# Parallel configuration
sfn:/dev/rdisk/c16t2d0                  sfn:/dev/rdisk/c16t2d1
sfn:/dev/rdisk/c16t2d0                  sfn:/dev/rdisk/c16t2d2

# MV:RV=1:1
sfn:/dev/rdisk/c22t3d0
```

To specify the replication operation file, use the -file option together with the replication operation commands and pair operation commands.

For information about how to describe and specify the replication operation file, refer to the “Data Replication Command Reference”.

4.5 Volume List Creation/Display

The function to create and display the volume list associates logical disk information (disk array side) with system dependent information (server side) and displays the associated information. Since it handles system dependent information, the function on the Windows system is different from the function on the UNIX system. On the Windows system, operations are possible by using the GUI (Graphical User Interface).

4.5.1 Command Operations (Windows)

On the Windows system, by using the volume list creation and display function by means of the `iSMvollist` command, it is possible to obtain and display drive letter, HBT (host adapter number/bus number/target ID) and LUN (logical unit number), physical disk and logical disk names, and associated OS type (hereafter, volume list) of logical disks in the disk arrays.

The following is the description of the HBT:

- Host adapter number: HBA

This is the number for an interface card that connects a SCSI bus to the host (system). There are multiple buses in the host adapter.

- Bus number: Bus

This is the number for the path (bus) from the host adapter to a target (SCSI device). One path can handle multiple targets.

- Target ID: Target ID

This ID is used for identifying a device that is connected to the SCSI bus. One ID is assigned to one disk array.

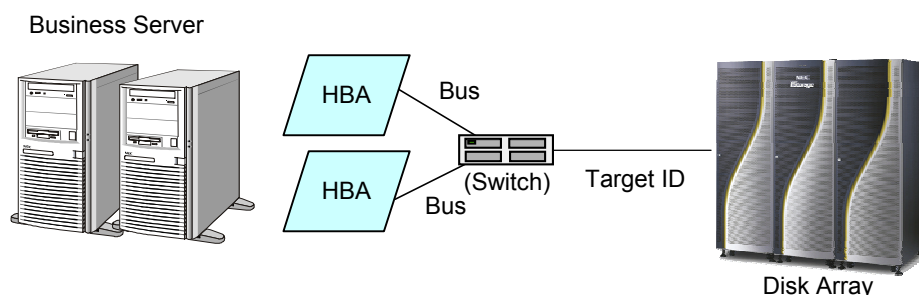


Figure 4-4 Relations between System Configuration and HBT

The iSMvollist command corresponds to the system information on the logical disk of the disk array that can be recognized from a business server and saves necessary volume information in the volume list.

Only the volumes that have already been registered in the volume list can be specified when data replication or snapshot operation is performed. Therefore, you need to execute the iSMvollist command to create the volume list beforehand.

When you have added or deleted disk arrays to or from the system or built or cancelled logical disks, you must update the volume list to reflect the information. If the volume list is not updated, inconsistency may occur in data replication or snapshot operation or disk operations, such as flushing or unmounting Windows volumes.

[Main Options]

You can specify one of the following options in the iSMvollist command.

(i) Create/update the volume list (-cr)

Scans devices connected to the system and creates or updates the volume list.

(ii) Displays the volume list

You can select one of the following options.

-d option: Lists disk array information.

-dl option: Displays information only associated with specified disk arrays sorted by using logical disk number as the key. If a specific logical disk name is specified, the system displays information only associated with the specified logical disk.

-de option: Displays information only associated with specified disk arrays sorted by using logical disk name as the key. If a specific logical disk name is specified, the system displays information only associated with the specified logical disk name.

-dd option: Displays information only associated with specified disk arrays sorted by using drive name as the key. If a specific drive letter or a path name of the NTFS folder is specified, the system displays information only associated with the specified drive letter or path name of the NTFS folder.

-dp option: Displays information only associated with specified disk arrays sorted by using physical disk number as the key. If a specific physical disk number is specified, the system displays information only associated with the specified physical disk.

-dh option: Displays information only associated with specified disk arrays sorted by using HBT and LUN as the key. If HBT is specified, the system displays information only associated with the specified HBT. If LUN is specified, the system displays information only associated with the specified HBT and LUN.

-a option: Displays information associated with all logical disks.

-al option: Displays information only associated with specified logical disks.

-ae option: Displays information only associated with specified logical disk names.

- ad option: Displays information only associated with a specified drive name or a path name of the NTFS folder.
- ap option: Displays information only associated with specified logical disk numbers.
- av option: Displays information only associated with specified mount point volume names.
- ah option: Displays information only associated with specified HBT. If LUN is also specified, the system displays information only associated with specified HBT and LUN.
- ctl option: Lists the physical disk numbers and logical disk numbers of control volumes and the corresponding disk array names.
- p option: Displays the version information and the date when the volume list is created as the property information of the volume list.
- ax option: Lists disk array information, correspondence of all logical disks, and the property information of the volume list.

[Displayed Information]

- (i) When the -cr option is specified:

When the volume list is created or updated successfully, the following message appears.

iSM11700: Please wait a minute.

iSM11701: Volume list is created successfully.

- (ii) When the -d option is specified:

Disk array information as shown below is listed.

--- Disk Array List ---

Disk Array Name	Number of Drives
disk_array_name	number

Description

disk_array_name: Disk array name

number: Number of logical disk information (volume information) items for each disk array registered in the volume list

- (iii) When the -a option is specified:

Correspondence information about logical disks as shown below is listed.

LDN	LD Name			VAA	OS Type
HBT		LUN	Disk No.	Disk Array	
Volume Name					
Path					
ldn ld_name				vaa	type
hbt		lun	disk_num	disk_array_name	
volume_name					
path					

Description

ldn: Logical disk number
 ld_name: Logical disk name
 vaa: VAA (Volume Absolute Address)
 type: OS type
 hbt: Host adapter number, bus number, target ID
 lun: LUN
 disk_num: Physical disk number
 disk_array_name: Disk array name
 volume_name: Mount point volume name
 path: Drive letter or path name mounted in the NTFS volume folder accessed by a user

- (iv) When the -ctl option is specified:

Information on control volumes as shown below is listed.

--- Control Volume List ---

Disk No.	LDN	Disk Array Name
disk_num	ldn	disk_array_name

Description

disk_num: Physical disk number
 ldn: Logical disk number
 disk_array_name: Disk array name

- (v) When the -p option is specified:

Property information of the volume list as shown below is listed.

--- Property of Volume List File ---

Version	version
Created	YYYY/MM/DD hh:mm:ss
Owner Host Name	host_name
Disk Array	disk_array_number
Volume Information	volume_number

Description

version:	Version of the iSMvollist command used to create the volume list
YYYY/MM/DD hh:mm:ss:	Date when the volume list is created or updated
host_name:	Host name of the server owning the volume list
disk_array_number:	Total number of disk arrays in the volume list
volume_number:	Total number of volume information items in the volume list

- (vi) When the -ax option is specified:

Disk array information, information on correspondence of logical disks, and property information of the volume list are listed as shown below.

Volume List iSMvollist Version X.X.XXX Date: YYYY/MM/DD HH:MM:SS

--- Disk Array List ---

Disk Array Name	Number of Drives
disk_array_name	number

--- Volume List ---

LDN	LD Name	VAA	OS Type
HBT	LUN	Disk No.	Disk Array
Volume Name			
Path			
ldn	ld_name	vaa	type
hbt	lun	disk_num	disk_array_name
volume_name			
path			

--- Property of Volume List File ---

Version	version
Created	yyyy/mm/dd hh:mm:ss
Owner Host Name	host_name

Disk Array	disk_array_number
Volume Information	volume_number
<u>Description</u>	
X.X.XXX:	Version information on the executed iSMvollist command
YYYY/MM/DD HH:MM:SS:	Execution date of the iSMvollist command
disk_array_name:	Disk array name
number:	Number of logical disk information (volume information) items for each disk array registered in the volume list
ldn:	Logical disk number
ld_name:	Logical disk name
vaa:	VAA (Volume Absolute Address)
type:	OS type
hbt:	Host adapter number, bus number, and target ID
lun:	LUN
disk_num:	Physical disk number
volume_name:	Mount point volume name
path:	Drive letter or path name mounted to the folder of the NTFS volume the user accesses
version:	Version information of the iSMvollist command used to create the volume list
yyyy/mm/dd hh:mm:ss:	Date when the volume list is created or updated
host_name:	Host name of the server owning the volume list
disk_array_number:	Total number of disk arrays in the volume list
volume_number:	Total number of volume information items in the volume list

[Execution Conditions]

To create and display the volume list, the following conditions must be satisfied:

- (i) While the volume list is being created or updated, it is not possible to display the volume list or execute replication operation commands and snapshot operation commands.

4.5.2 Command Operations (UNIX)

On the UNIX system, by using the volume list creation and display function by means of the iSMvollist command, it is possible to obtain and display special file name, logical disk name, and associated OS type (hereafter, volume list) of the logical disks in the disk arrays.

To use the replication operation function, it is necessary to create the volume list beforehand by executing the iSMvollist command because only the volumes that have already been registered in the volume list are targets.

Only an appropriate privileged user (superuser) can create or update the volume list.

When you have added or deleted disk arrays to or from the system or built or cancelled logical disks, you must update the volume list to reflect the information. If the volume list is not updated, data inconsistency may occur during data replication and snapshot operations.

[Main Options]

The following options can be specified in the iSMvollist command.

(i) Creating/updating the volume list (-r)

It is possible to scan devices connected to the system and create or update the volume list.

The volume list can be automatically created at the start of the business server. However, if settings remain unchanged since installation, the volume list cannot be automatically created, and therefore, will need to be manually created. To automatically create it, it is necessary to change the name of the rc file that has been created at the installation.



The HP-UX system executes ioscan(1M) to obtain device information when the volume list is created (iSMvollist -r). To do so, it uses the -k option so as to obtain device information from the kernel rather than from the actual hardware. Therefore, even though the hardware is made available, the actual hardware may not be made available. In this case, creation or update of the volume list fails and the following message appears.

iSM11758: System call error (error code=214)

If this error message appears, execute the ioscan -fn to confirm the state of the actual hardware.

(ii) Displaying the volume list

One of the following options can be selected.

- | | |
|-------------|--|
| -d option: | Lists disk array information. |
| -l option: | Displays information associated with all logical disks. |
| -vs option: | Displays information only associated with specified disk arrays sorted by using special file name as the key. If a specific special file name is specified, the system displays information only associated with the specified |

	special file.
-vl option:	Displays information only associated with specified disk arrays sorted by using logical disk number as the key. If a specific logical disk number is specified, the system displays information only associated with the specified logical disk number.
-ve option:	Displays information only associated with specified disk arrays sorted by using logical disk name as the key. If a specific logical disk name is specified, the system displays information only associated with the specified logical disk name.
-ctl option:	Lists the special file name and logical disk number of a control volume and the corresponding disk array name.
-p option:	Displays the version information and the date when the volume list was created as property information of the volume list.
-ax option:	Lists disk array information, correspondence of all logical disks, and property information of the volume list.

[Displayed Information]

- (i) When the -r option is specified:

When the volume list is created or updated successfully, the following message appears.

iSM11700: Please wait a minute.

iSM11100: Command has completed successfully.

- (ii) When the -d option is specified:

The disk array information as shown below is listed.

--- Disk Array List ---

Disk Array Name	Number of LDN
disk_array_name	number

Description

disk_array_name:	Disk array name
number:	Number of logical disk information items (special file) for each disk array registered in the volume list

- (iii) When the -l option is specified:

Information of the correspondence of the logical disks as shown below is listed.

LDN	LD NAME	VAA	TYPE
	Special File	Disk Array	Path
ldn	ld_name	vaa	type
	special_file_name	disk_array_name	path

Description

ldn:	Logical disk number
ld_name:	Logical disk name
vaa:	VAA (Volume Absolute Address)
type:	OS type
special_file_name:	Special file name
disk_array_name:	Disk array name
path:	Whether to use a special file
	Usually this field is blank and nothing appears in this field, however, when data replication or snapshot is performed, if an error is detected in access to the special file, "B" appears.

About the state of Path (whether to use a special file)

Establishing multiple connections to the same logical disk enables a path (special file) to have redundant configuration. In this case, for each command of data replication or snapshot, when an error is detected in access to the path (special file) used for issuing an I/O, access is switched automatically to another path (special file) registered in the volume list and I/O continuation to a disk array is tried.

When an error is detected in access to a path (special file), "B" is displayed in the Path information of the special file used at the time, which indicates an error occurs in the special file. After a path error is recovered, when access to a volume by a blocked path is established successfully, the Path information of the special file is cleared and the blocked state is released.

- (iv) When the -ctl option is specified:

Information on a control volume as shown below is listed.

--- Control Volume List ---

Special File	LDN	Disk Array Name	Path
special_file_name	ldn	disk_array_name	path

Description

special_file_name:	Special file name
ldn:	Logical disk number
disk_array_name:	Disk array name
path:	Whether to use a special file
	Usually this field is blank and nothing appears in this field, however, when data replication or snapshot is performed, if an error is detected in access to the special file, "B" appears.

- (v) When the -p option is specified:

Property information of the volume list as shown below is displayed.

--- Property of Volume List File ---

Version	version
Created	YYYY/MM/DD hh:mm:ss
Owner Host Name	host_name
Disk Array	disk_array_number
Volume Information	volume_number

Description

version:	Version of the iSMvollist command used for creating the volume list
YYYY/MM/DD hh:mm:ss:	Date when the volume list was created or updated
host_name:	Host name of the server owning the volume list
disk_array_number:	Total number of disk arrays in the volume list
volume_number:	Total number of volume information items in the volume list

- (vi) When the -ax option is specified:

Disk array information, correspondence information of logical disks, and property information of the volume list are listed as shown below.

Volume List iSMvollist Version X.X.XXX Date: YYYY/MM/DD HH:MM:SS

--- Disk Array List ---

Disk Array Name	Number of LDN
disk_array_name	number

--- Volume List ---

LDN	LD NAME	VAA	TYPE
	Special File	Disk Array	Path
ldn	ld_name	vaa	type
	special_file_name	disk_array_name	path

--- Property of Volume List File ---

Version	version
Created	yyyy/mm/dd hh:mm:ss
Owner Host Name	host_name
Disk Array	disk_array_number
Volume Information	volume_number

Description

X.X.XXX:	Version information of the executed iSMvollist command
YYYY/MM/DD HH:MM:SS:	Execution date of the iSMvollist command
disk_array_name:	Disk array name
number:	Number of logical disk information items (special file) for each disk array registered in the volume list
ldn:	Logical disk number
ld_name:	Logical disk name
vaa:	VAA (Volume Absolute Address)
type:	OS type
special_file_name:	Special file name
disk_array_name:	Disk array name
path:	Whether to use a special file Usually this field is blank and nothing appears in this field, however, when data replication or snapshot is performed, if an error is detected in access to the special file, "B" appears.
version:	Version information of the iSMvollist command used to create the volume list
yyyy/mm/dd hh:mm:ss:	Date when the column list was created or updated
host_name:	Host name of the server owning the volume list
disk_array_number:	Total number of disk arrays in the volume list
volume_number:	Total number of volume information items in the volume list

[Execution Conditions]

To create and display the volume list, the following conditions must be satisfied:

- (i) While the volume list is being created or updated, it is not possible to display the volume list or execute replication operation commands and snapshot operation commands.
- (ii) While the iSM Server is running on the same server, the volume list only can be displayed, but it cannot be created or updated. (HP-UX version UNIX system)
- (iii) The iSM special file is not being created (HP-UX version UNIX system only).

4.5.3 GUI Operations (Windows)

On the Windows system, the volume list creation and display function can be used via the GUI. The GUI functions include volume list display, selective display of disk arrays, and creation and update of the volume list.

The function to define control volumes used for the business server to operate the data replication or snapshot function is also provided.

[Screen Configuration]

To create or display the volume list with GUI, use the Volume List Display screen. The following is the layout of the Volume List Display screen.

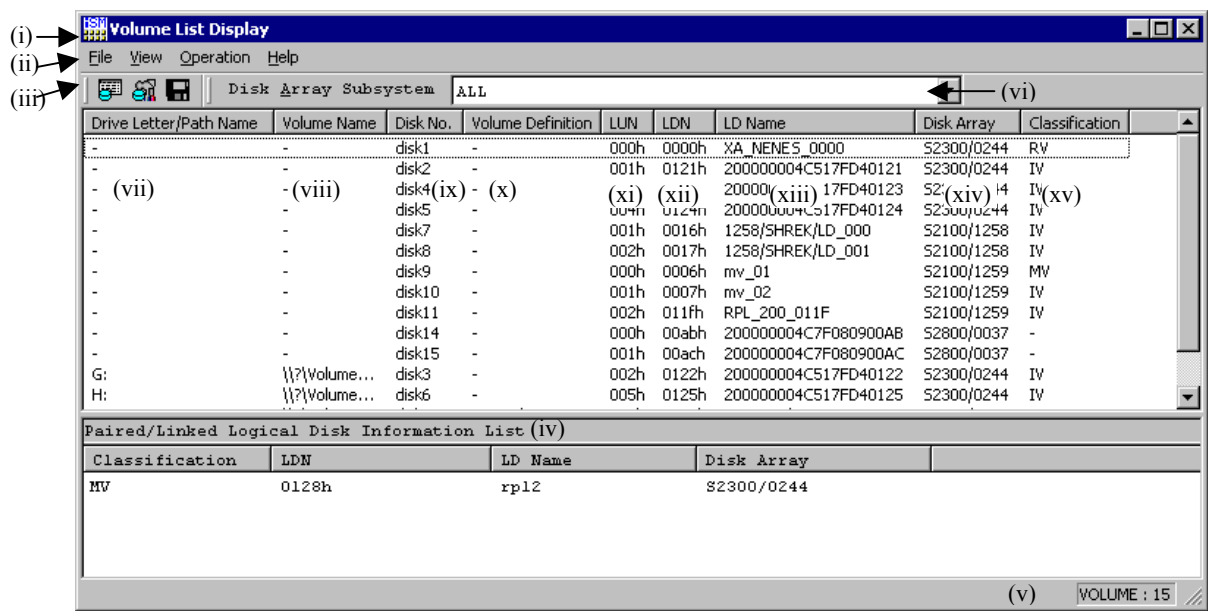





Figure 4-5 Layout of Volume List Display Screen

- (i) Title bar
Displays the title of the Volume List Display function.
- (ii) Menu bar
For details on each item of the menu bar, refer to “Menu Item List” on page 126.

(iii) Toolbar buttons

Toolbar Button	Description
 [Create/Update Volume List]	Clicking this button has the same effect as selecting [Create/Update Volume List] from the menu.
 [Define Control Volume]	Clicking this button has the same effect as selecting [Define Control Volume] from the menu.
 [CSV Output of Information List]	Clicking this button has the same effect as selecting [CSV Output of Information List] from the menu.

(iv) Paired/Linked Logical Disk Information List

Displays logical disk information paired with the volume selected from the Volume List Display screen by the data replication or snapshot function by obtaining from a disk array. When a logical disk is connected to a link-volume, the linked logical disk information is displayed by obtaining from a disk array.

(v) Status bar

The following information appears on the status bar.

VOLUME: Displays the number of volume information items to be displayed on the Volume List Display screen. If volume information of all disk arrays is displayed, the number of all volume information items in the volume list is displayed. For display by narrowing down disk arrays, the number of volume information items of the target disk array is displayed.

(vi) Disk Array Selection Combo box

Clicking the pull-down button displays the list of disk arrays currently registered in the Volume List file.

(vii) Drive Letter/Path Name

Displays path information in the Volume List file.

(viii) Volume Name

Displays volume names in the Volume List file.

(ix) Disk No.

Displays physical disk numbers in the Volume List file.

(x) Volume Definition

Displays the identification information of control volume definition.

(xi) LUN

Displays logical unit numbers in the Volume List file.

(xii) LDN

Displays logical disk numbers in the Volume List file.

(xiii) LD Name

Displays logical disk names in the Volume List file.

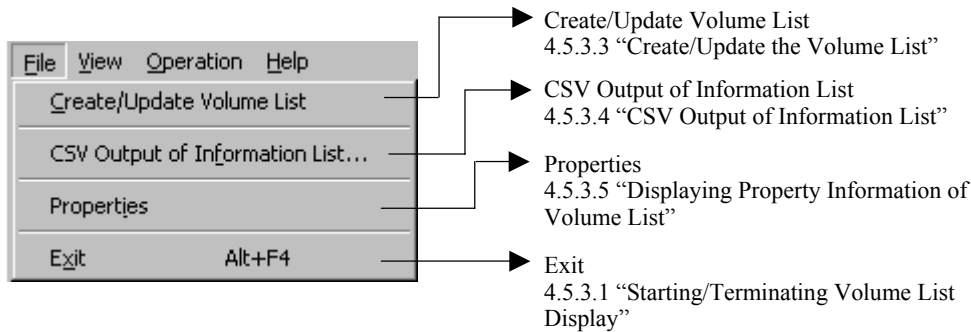
- (xiv) Disk Array
Displays disk array names in the Volume List file.
- (xv) Classification
Displays the type (volume attribute) of volumes regarding data replication and snapshot by obtaining from a disk array.

The information items (vi) to (xiv) above are displayed by obtaining from the volume list, however, the information items (iv) and (xv) are displayed by obtaining from a disk array.

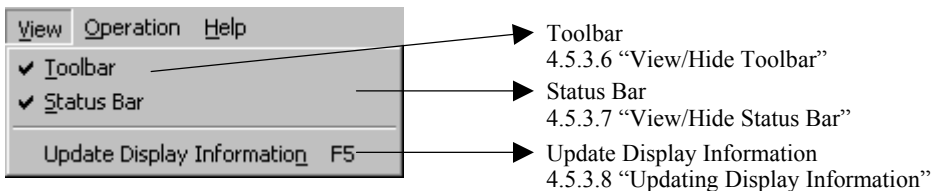
[Menu Item List]

This section describes the items on the menu bar of the Volume List Display screen.

• File menu



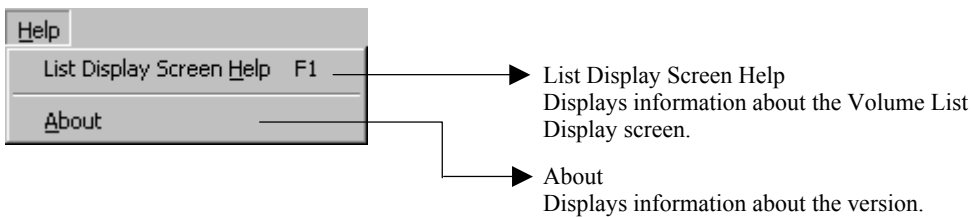
• View menu



• Operation menu



• Help menu



4.5.3.1 Starting/Terminating Volume List Display

This section describes the procedures for starting and terminating the Volume List Display function.

[Operation Procedure]

Starting Volume List Display screen

- (1) Select [Start] of Windows → [Programs] ([All Programs] for Windows Server 2003) → [Storage Manager Volume List] → [Volume List Display].
- (2) The Volume List Display screen appears.

Drive Letter/Path Name	Volume Name	Disk No.	Volume Definition	LUN	LDN	LD Name	Disk Array	Classification
-	-	disk1	-	000h	00a8h	DAS_Find_0...	S2800/0021	IV
-	-	disk2	-	001h	00a9h	DAS_Find_0...	S2800/0021	IV
-	-	disk3	-	000h	0000h	NE_NCNEE_...	S2300/0244	RV
-	-	disk4	-	001h	0121h	200000004C...	S2300/0244	IV
-	-	disk6	-	003h	0123h	200000004C...	S2300/0244	IV
-	-	disk7	-	004h	0124h	200000004C...	S2300/0244	IV
-	-	disk9	-	001h	0016h	1258/SHREK...	S2100/1258	IV
-	-	disk10	-	002h	0017h	1258/SHREK...	S2100/1258	IV
-	-	disk11	-	000h	0006h	mv_01	S2100/1259	MV
-	-	disk12	-	001h	0007h	mv_02	S2100/1259	IV
-	-	disk13	-	002h	011fh	RPL_200_011F	S2100/1259	IV
G:	\\?\Volume{...	disk5	-	002h	0122h	200000004C...	S2300/0244	IV
H:	\\?\Volume{...	disk8	-	005h	0125h	200000004C...	S2300/0244	IV

Paired/Linked Logical Disk Information List			
Classification	LDN	LD Name	Disk Array
RV	0008h	rv_01	S2100/1259

VOLUME : 13

Figure 4-6 Volume List Display Screen

Terminating the Volume List Display screen

Do one of the following:

- Select [Exit] in [File] on the menu bar of the Volume List display screen.
- Click the [close] button of the system menu.

When the Volume List Display screen is terminated, the window size, column width of the list view, and screen position on the Volume List Display screen being displayed are stored automatically. The stored screen information takes effect when the Volume List Display screen is started next.

4.5.3.2 Selecting Disk Array Name

Click the pull-down button of disk array Selection Combo box on the screen of Volume List Display, and select the target disk array. The information of only the selected disk array is displayed.

[Operation Procedure]

- (1) Select the target disk array from the disk array Selection Combo box on the screen of Volume List Display.
- (2) The volume information on the selected disk array is listed.

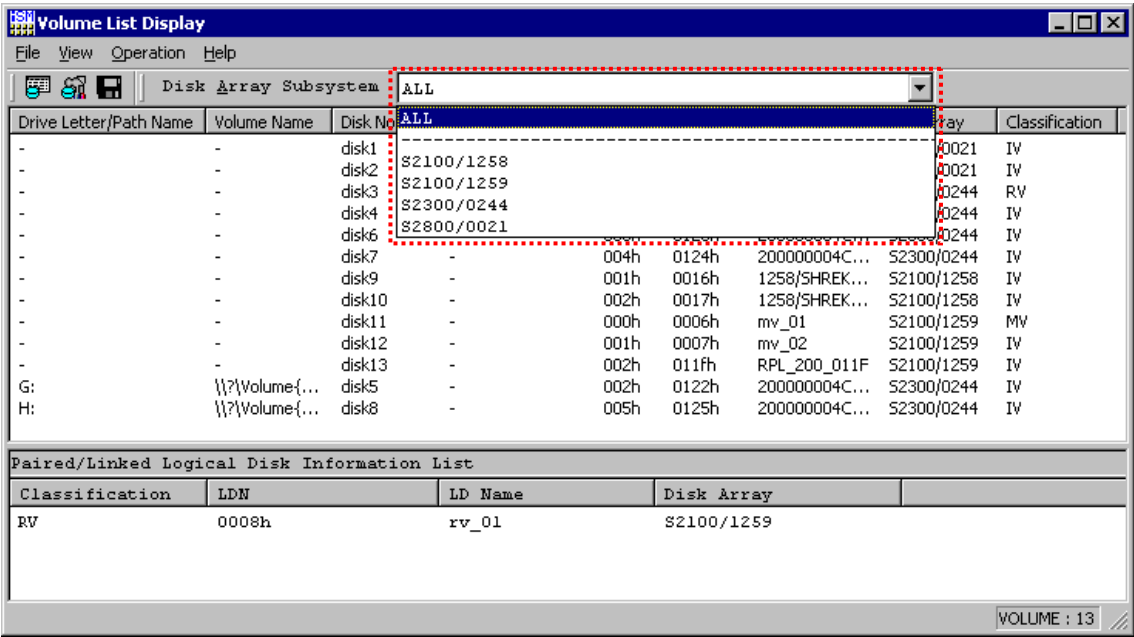


Figure 4-7 Narrowed-down Display by Disk Array

4.5.3.3 Create/Update the Volume List

To update the Volume List, select [File] and then select [Create/Update Volume List] on the Volume List Display screen.

[Operation Procedure]

- (1) Select [File] and then select [Create/Update Volume List] on the Volume List Display screen.
The following inquiry message is displayed:

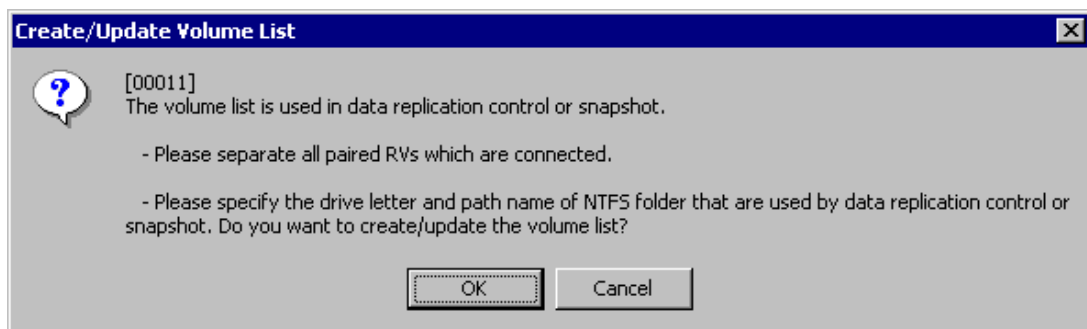


Figure 4-8 Execution Confirmation Screen for Create/Update Volume List

- (2) Clicking the [OK] button executes Create/Update Volume List.
Clicking the [Cancel] button cancels Create/Update Volume List and returns to the Volume List Display screen.
- (3) The following message appears when the Volume List has been created/updated successfully.

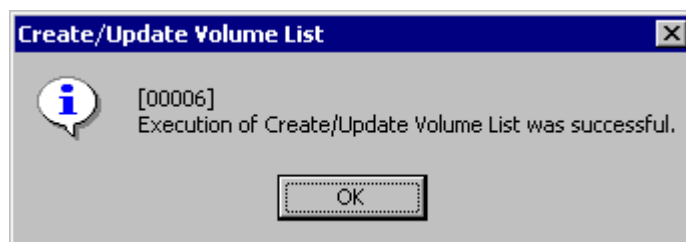


Figure 4-9 Confirmation Screen for Create/Update Volume List

- (4) Clicking the [OK] button returns to the Volume List Display screen.
- (5) The Volume List Display screen is automatically updated after the Volume List file has been created/updated.

4.5.3.4 CSV Output of Information List

The information displayed on the Volume List Display screen is output as a CSV file and then saved.

[Operation Procedure]

Select [File] and then select [CSV Output of Information List] on the Volume List Display screen.

The CSV Output of Information List screen appears.

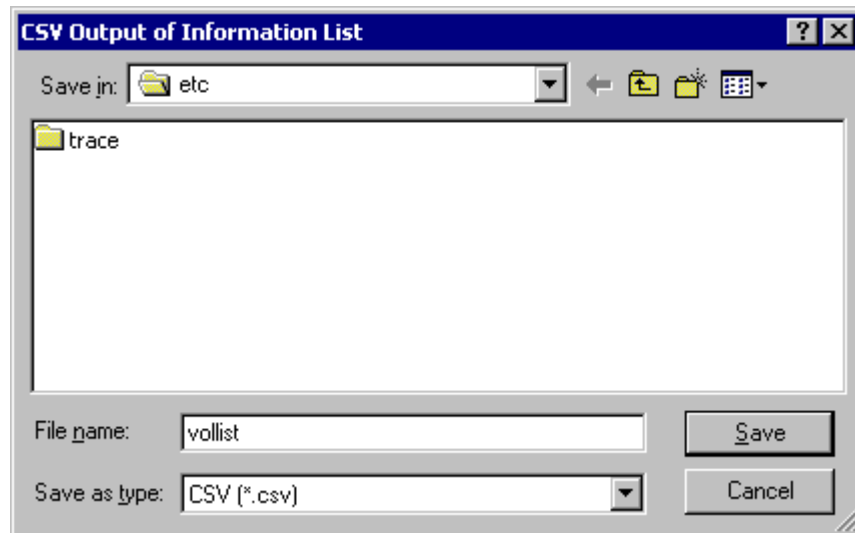


Figure 4-10 CSV Output of Information List Screen

- (1) Specify the save destination.
The default save destination is the “etc” folder in the installation directory.
- (2) Specify the file name.
The default file name is “vollist.csv”.
- (3) Click the [Save] button to save the input information.
When the [Cancel] button is clicked, the screen is returned to the Volume List Display screen without saving the file.
- (4) When the file has been saved successfully, the following message appears:

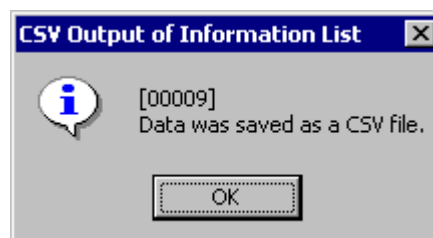


Figure 4-11 Confirmation Screen for CSV Output of Information List

- (5) Clicking the [OK] button returns to the Volume List Display screen.

[File Example]

The following example shows the CSV file that is output as the result of the CSV output of the information display list.

```
Drive Letter/Path Name,Volume Name,Disk No.,Volume Definition,LUN,LDN,LD Name,
Disk Array,Classification,Paired/Linked Logical Disk Information List
-,\?\Volume{cce89866-4d87-11d8-92a3-806d6172696f}\,disk1,Control,000h,000ah,BACK
UP_CV,Tokyo_Customer_DataBase, IV,-
E:,\?\Volume{cce89867-4d87-11d8-92a3-806d6172696f}\,disk2,-,001h,0005h,DB_DATA_
RV,Tokyo_Customer_DataBase,RV,"MV(0005h,DB_DATA_MV,
Tokyo_Customer_DataBase)"
F:,\?\Volume{cce89868-4d87-11d8-92a3-806d6172696f}\,disk3,-,002h,0006h,
DB_REDO1_RV,Tokyo_Customer_DataBase,RV,"MV(0006h,DB_REDO1_MV,
Tokyo_Customer_DataBase)"
G:,\?\Volume{cce89869-4d87-11d8-92a3-806d6172696f}\,disk4,-,003h,0007h,
DB_REDO2_RV,Tokyo_Customer_DataBase,RV,"MV(0007h,DB_REDO2_MV,
Tokyo_Customer_DataBase)"
H:,\?\Volume{cce8986a-4d87-11d8-92a3-806d6172696f}\,disk5,-,004h,0008h,
DB_CTL_RV,Tokyo_Customer_DataBase,RV,"MV(0008h,DB_CTL_MV,
Tokyo_Customer_DataBase)"
I:,\?\Volume{cce8986b-4d87-11d8-92a3-806d6172696f}\,disk6,-,005h,0009h,
DB_ARCHIVE_RV,Tokyo_Customer_DataBase,RV,"MV(0009h,DB_ARCHIVE_MV,
Tokyo_Customer_DataBase)"
M:,\?\Volume{cce8986f-4d87-11d8-92a3-806d6172696f}\,disk10,-,000h,0004h,
LD0004_MV,S2800,MV,"RV(0011h,LD0011_RV1,S2800)/RV(0012h,LD0012_RV2,
S2800)/RV(0013h,LD0013_RV3,S2800)"
```

Figure 4-12 Output Example of CSV File

This file outputs information displayed on the Volume List Display screen by separating each piece of information by commas.

The information for a volume is output as information for a line.

The information on the logical disks displayed in the Paired/Linked Logical Disk Information List is output in the following format. Information items on multiple logical disks are delimited and linked with slashes and output.

“*Classification (LDN, LDName, DiskArray) [/Classification(LDN, LDName, DiskArray) [...]]*”

<i>Classification:</i>	Classification
<i>LDN:</i>	Logical disk number
<i>LDName:</i>	Logical disk name
<i>DiskArray:</i>	Disk array name

4.5.3.5 Displaying Property Information of Volume List

To check property information of the volume list, select [File] → [Properties] on the Volume List Display screen.

[Operation Procedure]

- (1) To display property information, select [File] → [Properties] on the Volume List Display screen.
- (2) To return to the Volume List Display screen, click the [Close] button.

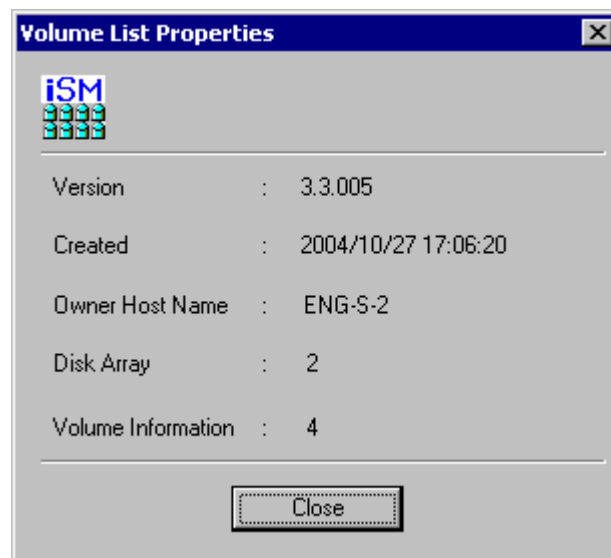


Figure 4-13 Property Information of Volume List

- Version
Displays the version information of the Storage Manager Volume List used to create the volume list.
- Created
Displays the date when the volume list was created.
- Owner Host Name
Displays the host name of the server owning the volume list.
- Disk Array
Displays the total number of disk arrays in the volume list.
- Volume
Displays the total number of volume information items in the volume list.

4.5.3.6 View/Hide Toolbar

To select whether to view or hide the toolbar, specify [View] → [Toolbar] on the Volume List Display screen.

View

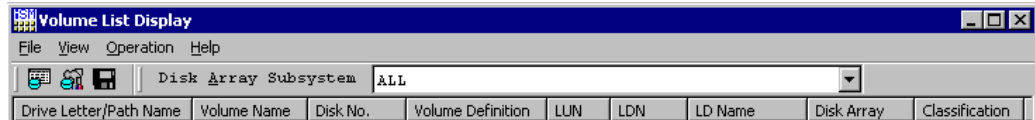


Figure 4-14 Viewing Toolbar

Hide

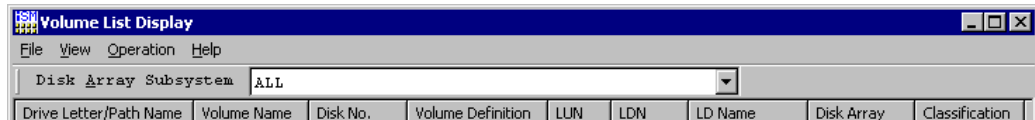


Figure 4-15 Hiding Toolbar

4.5.3.7 View/Hide Status Bar

To select whether to view or hide the status bar, specify [View] → [Status Bar] on the Volume List Display screen.

View



Figure 4-16 Viewing Status Bar

Hide



Figure 4-17 Hiding Status Bar

4.5.3.8 Updating Display Information

To update the information of the Volume List file, select [View] and then select [Update Display Information] on the Volume List Display screen.

The Volume List file contents are obtained and the Volume List Display screen is automatically updated.

4.5.3.9 Defining Control Volume

To start the screen for defining a control volume, select [Operation] → [Define Control Volume] from the Volume List Display screen.

A control volume is a volume used for issuing a control I/O to a disk array from a server. To define a control volume, prepare a volume beforehand, such as IV which can issue an I/O to a disk array from a server securely. Do not select RV or a link-volume (LV) of the snapshot function as a control volume, because they cannot be accessed from a server (OS) while data replication or snapshot is operated.

For a control volume, refer to 4.2.1 “Direct Operation for a Disk Array”.

[Operation Procedure]

- (1) To display the Define Control Volume screen, select [Operation] → [Define Control Volume] from the Volume List Display screen.

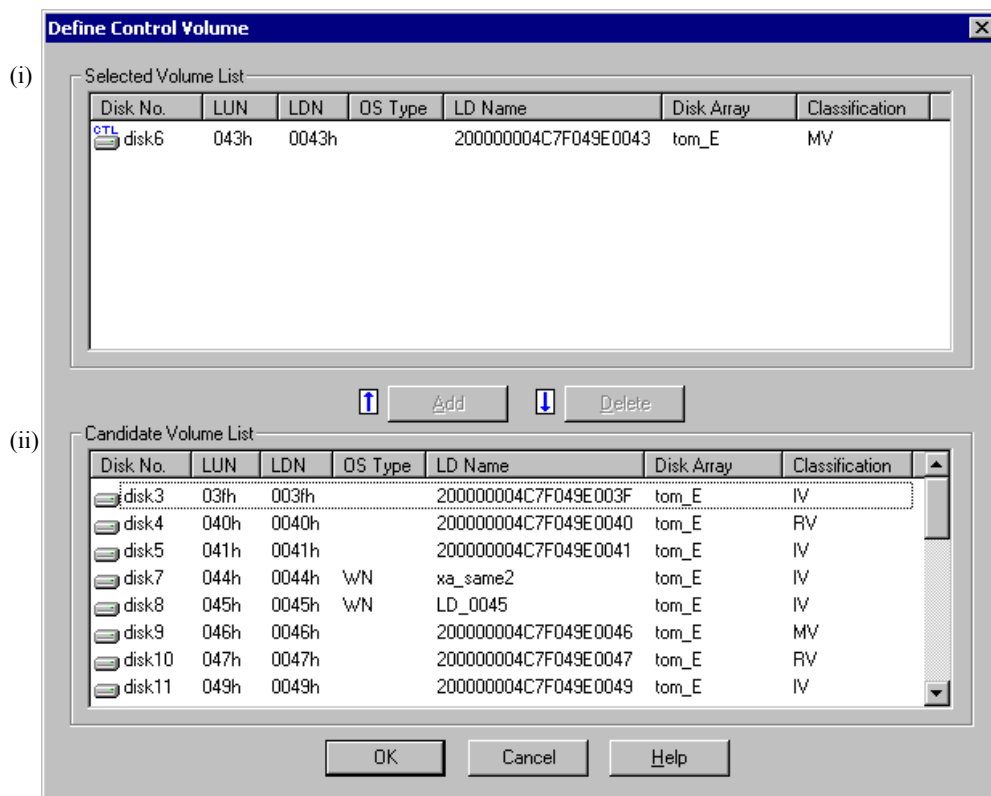


Figure 4-18 Define Control Volume Screen

Display items on the Define Control Volume screen are described below.

(i) Selected Volume List

Lists already-registered control volumes.



Displays a logical disk selected as a control volume.

(ii) Candidate Volume List

Lists candidates of logical disks that can be registered as a control volume.



Displays logical disks that can be registered as a control volume.

When the Define Control Volume screen is started, if an error is detected in the saved definition information, one of the following icons indicating an error appears.

Table 4-4 List of Icons Indicating Errors

Icon	Explanation and Action	
	Explanation	The disk array to which the control volume belongs cannot be recognized by the server.
	Action	Check the connection state of the server and disk array, and make the server recognize the disk array again. Check the Access Control state of the disk array, and check whether the necessary logical disk can be accessed from the server. When the control volume is not needed anymore, delete the control volume from [Selected Volume List].
	Explanation	The logical disk selected as the control volume cannot be recognized.
	Action	Check the Access Control state of the disk array, and check whether the necessary logical disk can be accessed from the server. To change the control volume, select another logical disk and update the control volume in [Selected Volume List]. When the control volume is not needed anymore, delete the control volume from [Selected Volume List].

(2) Register, change, or delete a control volume.

A control volume is used to issue a control I/O to a disk array from a server. A logical disk can be selected for each disk array.



Do not select RV or a link-volume (LV) with the snapshot as a control volume because they are put in the Not Ready state during operation.

- Register or change a control volume

To register or change a control volume, select the logical disk to be used as a control volume from [Candidate Volume List] and click the [Add] or [Update] button.

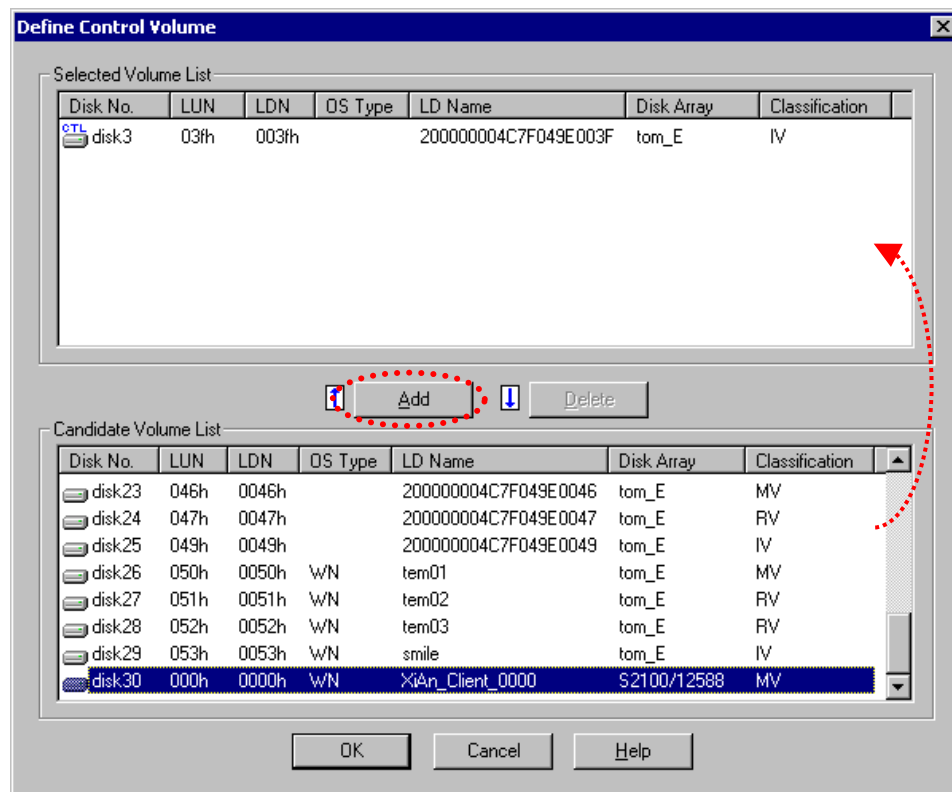


Figure 4-19 Register Control Volume

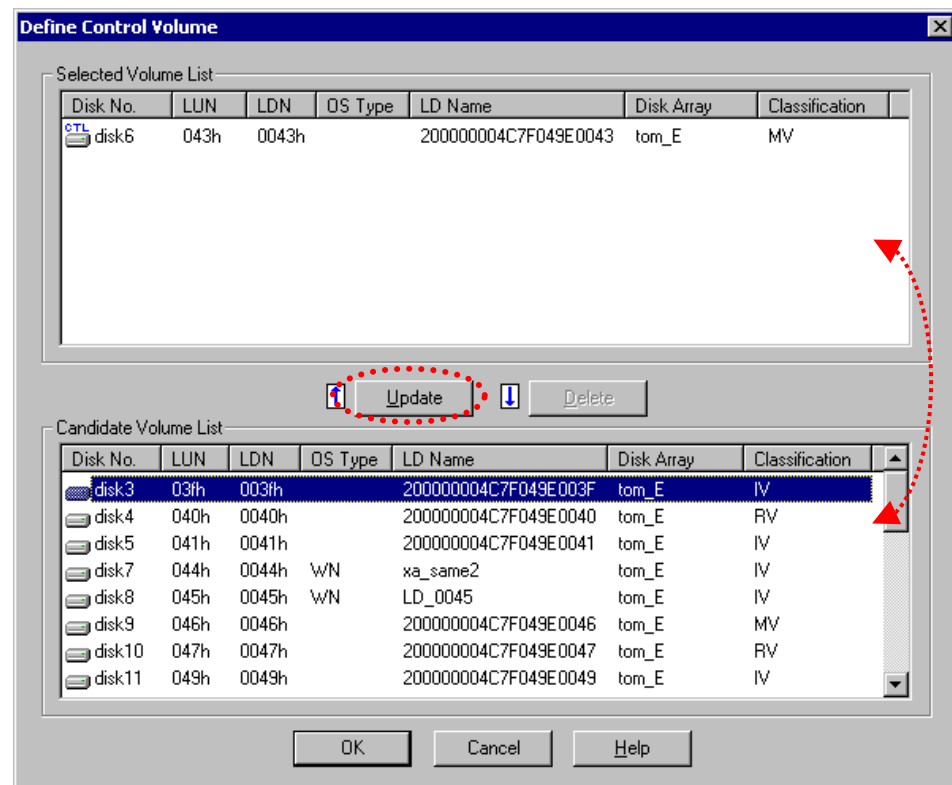


Figure 4-20 Change Control Volume

When you try to change a control volume that has already been registered in [Candidate Volume List], the following confirmation screen appears.

To change the control volume to the logical disk selected from [Selected Volume List], click the [Yes] button.

To return to the Define Control Volume screen without update, click the [No] button.

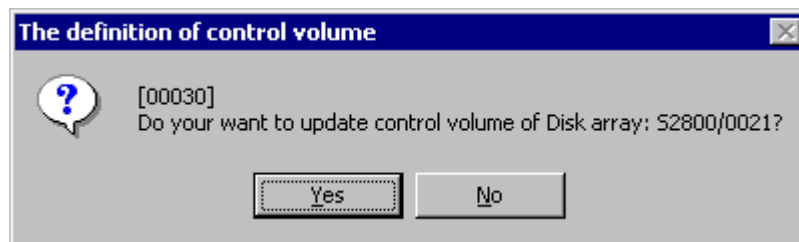


Figure 4-21 Change Confirmation Screen of Define Control Volume Screen

- Delete a control volume

To delete the control volume that has already been registered in [Selected Volume List], select the logical disk to be deleted from [Selected Volume List] and click the [Delete] button.

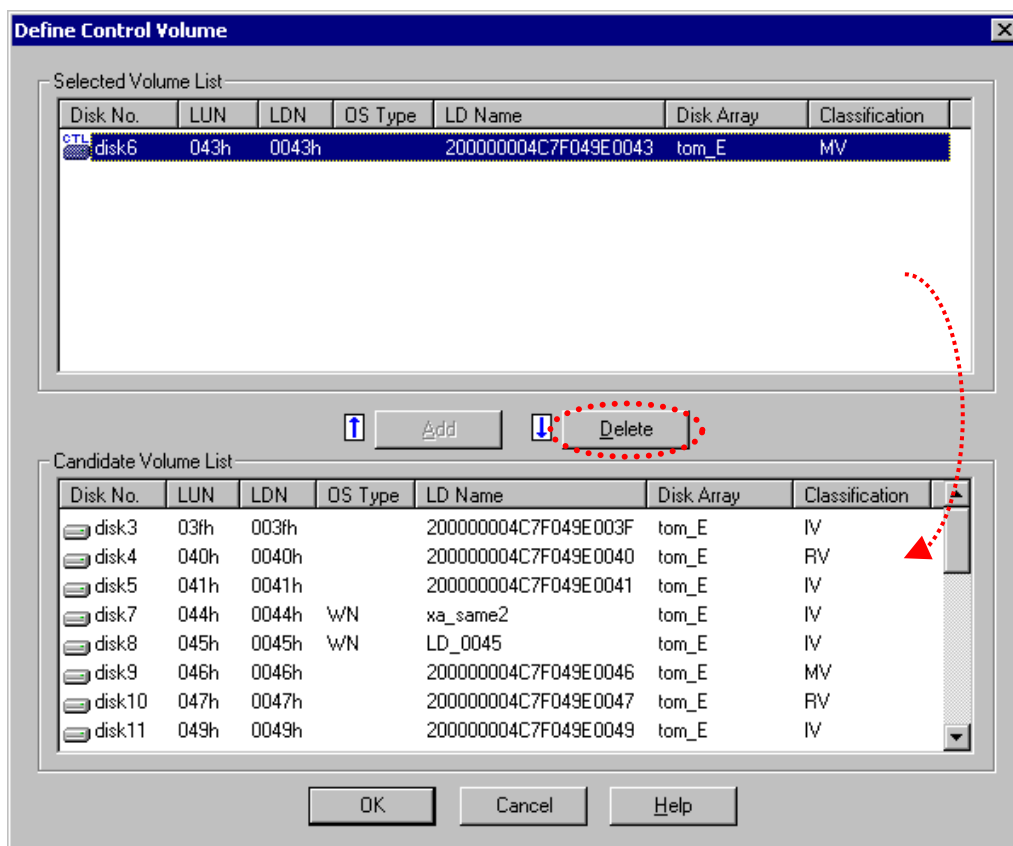


Figure 4-22 Delete Control Volume

- (3) When you click the [OK] button on the Define Control Volume screen, the message for confirming whether to save the definition information appears.

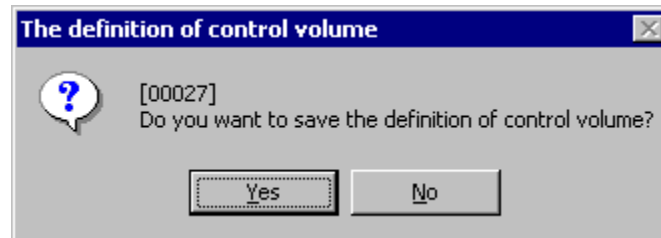


Figure 4-23 Save Confirmation Screen of Define Control Volume Screen

When you click the [Yes] button for the confirmation, the definition information is saved and the completion message appears.

To return to the Define Control Volume screen, click the [No] button.

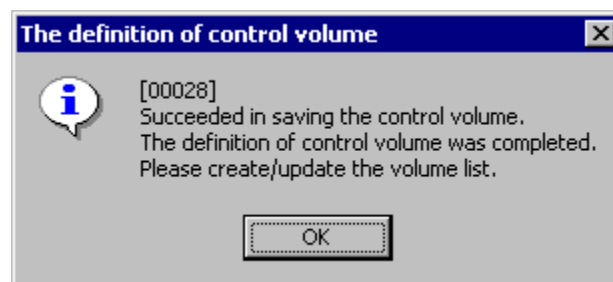


Figure 4-24 Completion Message Screen of Define Control Volume Screen

To close the Define Control Volume screen and return to the Volume List Display screen, click the [OK] button.

To enable the saved definition information, create or update the volume list to reflect the definition information of the control volume to the volume list.

When you click the [Cancel] button on the Define Control Volume screen, the message for confirming whether to cancel the definition appears.

When you click the [Yes] button for the confirmation, the definition information is not saved.

The Define Control Volume screen is closed and returned to the Volume List Display screen.

To return to the Define Control Volume screen, click the [No] button.

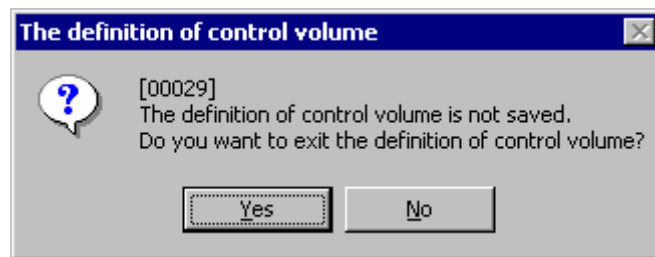


Figure 4-25 Cancel Confirmation Screen of Define Control Volume Screen

- (4) Update the volume list to reflect the updated definition information to the volume list.
Select [File] → [Create/Update Volume List] from the Volume List Display screen to create and update the volume list, and reflect the saved definition information of the control volume to the volume list for registration.

When the volume list is created or updated, the display of the Volume List Display screen is updated automatically. Confirm that the definition information is updated correctly by checking the displayed information of [Volume Definition].

4.6 Replication Operations

Replication operation commands provide a function to operate volumes by using disk array's Data Replication function as well as a function to obtain and display a variety of information.

4.6.1 Replicate Command

For Replicate, the iSMrc_replicate command is used.

By executing the iSMrc_replicate command, copy from MV to the paired RV starts.

Before Replicate is performed, MV and RV to be specified must be paired beforehand. In addition, the MV must be registered in the volume list (created by iSMvollist).

If MV and RV are used as file systems, the mount of the file systems must be canceled.

[Main Options]

For the iSMrc_replicate command, you can specify the following options regarding the Replicate operation.

(1) Specifying paired volumes

Specify MV and RV volumes.

- Specify MV (-mv volume -mvflg mv_flg)
Specifies the volume and volume type of MV.
- Specify RV (-rv volume -rvflg rv_flg)
Specifies the volume and volume type of RV.

For information on volume types, refer to 4.3 “Volume Types”.

On the Windows system, when a specific partition (drive letter) is specified for a volume consisting of multiple partitions, all partitions in the volume become operation targets; therefore, the default setting does not allow the multiple partitions to be operated. To perform operations for a volume consisting of multiple partitions, you need to change the default setting. For information about the replication operation option setting file, refer to the “Data Replication Command Reference”.

(2) Specifying the copy range (-cprange)

By default, only the difference area (diff) of MV and RV is copied. You can also instruct to copy the entire area (full) explicitly.

(3) Specifying the Copy Control state (-cpmode)

You can specify the Copy Control state during Replicate execution or in the Synchronous state. The following can be specified.

- Synchronous Copy (-cpmode sync)
Changes the Copy Control state to the Synchronous Copy mode.
- Semi-synchronous Copy (-cpmode semi)
Changes the Copy Control state to the Semi-synchronous Copy mode. This can be specified for pairs in different disk arrays.
- Background Copy (-cpmode bg)
Changes the Copy Control state to the Background Copy state.

(4) Specifying the access restrictions to RV (-rvacc)

You can specify the access restrictions to RV in Replicate Execution or when Replicate is complete.

- Not Ready (-rvacc nr)
Switches to the Not Ready state. Operations cannot be performed from the system.
- Read Only (-rvacc ro)
Only Read from the system can be performed.
Pay careful attention when you specify Ready Only (-rvacc ro) for the RV access restrictions.
For details, refer to 2.6 “RV Access Restriction”.

(5) Specifying the wait for Copy completion (-wait/nowait)

The system can wait for the completion of the command after Replicate has been performed until the Synchronous state starts.

- Wait Specified (-wait [second])
If a value is specified in second, the monitoring time interval of the disk array becomes the specified value. The available range is from 1 through 30 seconds (integer). If the value is omitted, the RPL_WATCHDEV setting in the replication operation option setting file is used for Windows while the setting of environment variable RPL_WATCHDEV is used for UNIX. For details on operational settings, refer to the “Data Replication Command Reference”.
- No Wait (-nowait)
Performs only a Replicate start instruction and terminates the command. You can check the termination of the command by the iSMrc_query or iSMrc_wait command.

[Displayed Information]

The iSMrc_replicate command displays messages when Replicate starts, during execution, and when Replicate ends.

On the Windows system

[Start message]

Replicate Start	YYYY/MM/DD hh:mm:ss
MV:disk_number	Id_name type
volume_name	
path	
RV:disk_number	Id_name type
volume_name	
path	

[Execution message]

Replicating.....

[End message]

Replicate Normal End	YYYY/MM/DD hh:mm:ss
MV:disk_number	Id_name type
volume_name	
path	
RV:disk_number	Id_name type
volume_name	
path	

Description

The execution message and the end message appear only when -wait has been specified to wait for the Replication completion state.

If you do not want the execution message to appear, change the RPL_WAITMSG setting in the replication operation option setting file. For information about the replication operation option setting file, refer to the “Data Replication Command Reference”.

YYYY/MM/DD hh:mm:ss:	Start/End time (Year Month Day Hour Minute Second)
disk_number:	Physical disk number
Id_name:	Logical disk name
type:	OS type
volume_name:	Mount point volume name
path:	Drive letter or path name mounted in the NTFS volume folder accessed by users
Replicating....:	The “.” character is dynamically updated until Replicate is completed.

On the UNIX system

[Start message]

```
Replicate Start      YYYY/MM/DD hh:mm:ss
    MV:special_file_name      Id_name      type
    RV:special_file_name      Id_name      type
```

[Execution message]

Replicating.....

[End message]

```
Replicate Normal End  YYYY/MM/DD hh:mm:ss
    MV:special_file_name      Id_name      type
    RV:special_file_name      Id_name      type
```

Description

The execution message and the end message appear only when -wait has been specified to wait for the Copy completion state.

If you do not want the execution message to appear, change the setting of the RPL_WAITMSG environment variable. For information about environment variables, refer to the “Data Replication Command Reference”.

YYYY/MM/DD hh:mm:ss: Start/End time (Year Month Day Hour Minute Second)
special_file_name: Special file name
Id_name: Logical disk name
type: OS type
Replicating...: The “.” character is dynamically updated until Replicate is completed.

[Execution Conditions]

To perform Replicate, the following conditions must be satisfied.

- (i) The target MV and RV have been paired.
- (ii) The target MV or RV has been registered in the volume list.
- (iii) The volume list is not being created or updated.
- (iv) RV has been unmounted from the system.
- (v) The disk array that stores the specified MV and RV is not in the Freeze state.
- (vi) The Activity State of the target pair is Separate.
- (vii) The pair of the specified MV and the paired RV is not in the Restore state.
- (viii) When the specified MV is also used as the base-volume (BV) of the snapshot function, restoration is not being executed from the snapshot-volume (SV).

- (ix) The Activity State of the pair of the specified MV and the paired upper MV is not in the Restore state.
- (x) The Activity State of the pair of the specified RV and the paired lower RV is not in the Restore state.
- (xi) The Semi-synchronous Copy mode cannot be specified for paired volumes set in the same disk array. The Semi-synchronous Copy mode can be specified only for paired volumes set in different disk arrays.
- (xii) Specifying a volume of a dynamic disk or a GPT-format partition disk is not allowed (Windows only).
- (xiii) The iSM dedicated special file is not being created (HP-UX version UNIX only).
- (xiv) When an LVM volume group or a VxVM disk group is specified, the target volume group or disk group must be active (UNIX only).
- (xv) When specifying the combination of an LVM volume group or a VxVM disk group with a special file name (logical disk name), you must specify the same number of logical volumes that make up the volume group or disk group as MV (RV) on the special file name (logical disk name) side.
In this case, Replication is performed in specified sequential order (UNIX only).

The above execution conditions (ii), (iii), (xii), (xiii), (xiv), and (xv) are not applicable when conducting a joint operation with the iSM (replication management).

Figure 4-26 illustrates the execution conditions of Replicate.

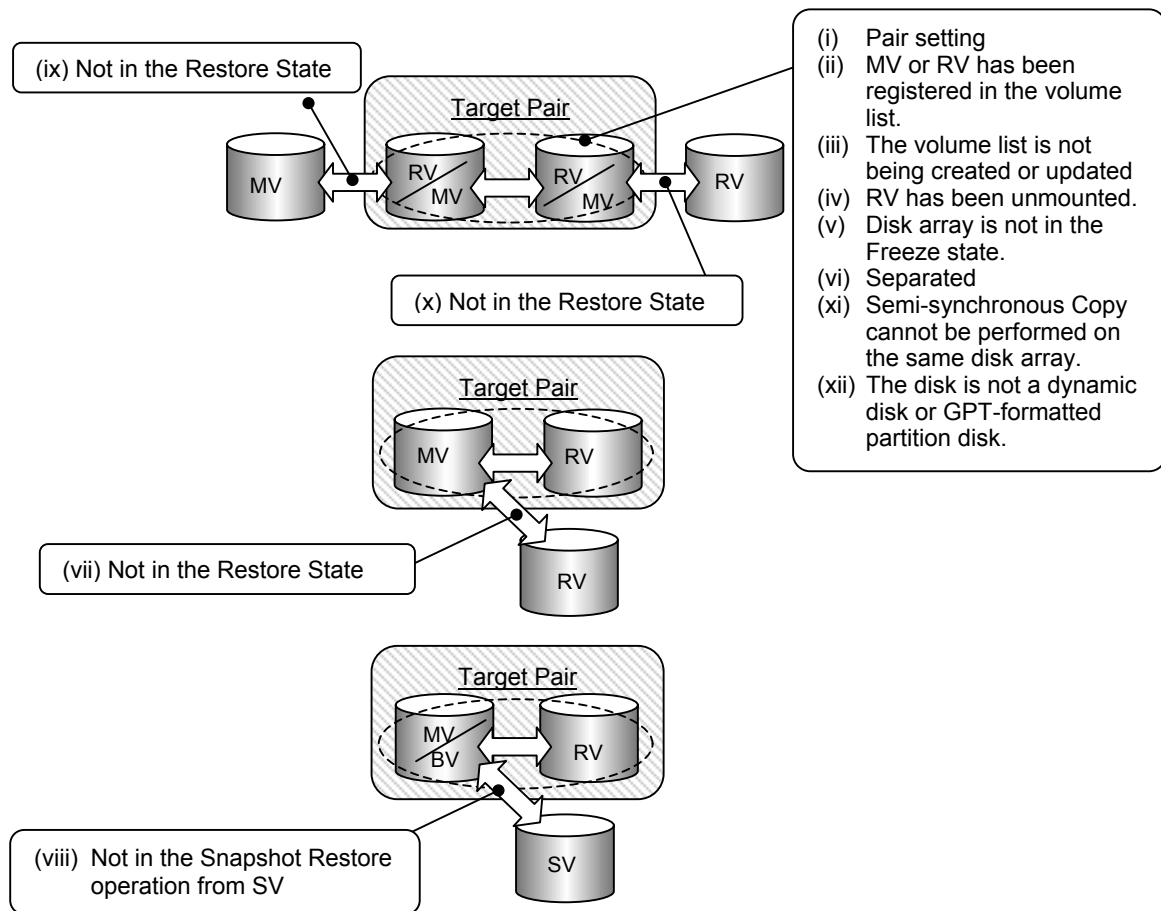


Figure 4-26 Execution Conditions of Replicate

4.6.2 Separate Command

For Separate, the iSMrc_separate command is used.

The iSMrc_separate command separates RV from MV and makes RV available from the system.

MV and RV must be set as a pair.

[Main Options]

For iSMrc_separate command, you can specify the following options regarding the Separate operation.

(1) Specifying paired volumes

Specify MV and RV volumes.

- Specify MV (-mv volume -mvflg mv_flg)
Specifies the volume and volume type of MV.
- Specify RV (-rv volume -rvflg rv_flg)
Specifies the volume and volume type of RV.

For information about volume types, refer to 4.3 “Volume Types”.

On the Windows system, when a specific partition (drive letter) is specified for a volume consisting of multiple partitions, all partitions in the volume become operation targets; therefore, the default setting does not allow the multiple partitions to be operated. To perform operations for a volume consisting of multiple partitions, you need to change the default setting. For information about the replication operation option setting file, refer to the “Data Replication Command Reference”.

(2) Specifying the access restrictions to RV after Separate(-rvacc)

You can specify the access restrictions to RV after Separate.

- Read/Write (-rvacc rw)
Reference and update can be performed for RV.
- Read Only (-rvacc ro)
Only reference can be performed for RV.
Pay careful attention when you specify Ready Only (-rvacc ro) for the RV access restrictions.
For details, refer to 2.6 “RV Access Restriction”.

(3) Specifying the wait for Separate completion(-wait /-nowait)

The system can wait for the command end after Separate until Separate is complete.

- Wait Specified (-wait [second])
If a value is specified in second, the monitoring time interval of the disk array becomes the specified value. The available range is from 1 through 30 seconds (integer). If the value is omitted, the RPL_WATCHDEV setting in the replication operation option setting file is used for Windows while the setting of environment variable RPL_WATCHDEV is used for UNIX.
For details on operational settings, refer to the “Data Replication Command Reference”.

- No Wait (-nowait)

Performs only a Separate start instruction and terminates the command. You can check the termination of the command by the iSMrc_query or iSMrc_wait command.

(4) Forced Separate (-force)

If a fault occurs in the connection between disk arrays and the normal Separate cannot be performed for MV and RV, you can specify the -force option to instruct Separate to MV and RV separately.

You can specify one of the following as a Forced Separate target.

- Perform Forced Separate for both MV and RV. (-force all)
- Perform Forced Separate only for MV. (-force mv)
- Perform Forced Separate only for RV. (-force rv)

When performing Forced Separate, note the following:

- If MV and RV are in the same system, the “all” is normally specified.
- Forced Separate by specifying MV or RV is used when MV and RV are in the different systems.
- When Forced Separate is performed by specifying MV (or RV), after the problem has been solved, Forced Separate must be performed by specifying RV (or MV) in the other system.
- If Forced Unpair is performed for either MV or RV, subsequent replication operations will not function properly because inconsistency occurs in the recognized states of MV and RV.

(5) RV use start time (-rvuse)

You can select one of the following as the time for making the RV available:

- Immediately after Separate execution (-rvuse immediate)

After Separate is started, RV becomes available even during execution of Separate while the difference between MV and RV is being reflected to RV.

- After completion of Separate (-rvuse complete)

After Separate is started, RV does not become available until the difference between MV and RV is fully reflected to RV and Separate is completed. RV cannot be used while the difference between MV and RV is being reflected to RV.

- According to the default setting (-rvuse default)

On the Windows system, the system follows the RVUSE specification in the replication operation option setting file. On the UNIX system, the system follows the setting of the RPL_SEP_RVUSE environment variable. For details of each setting, refer to the “Data Replication Command Reference”.

[Displayed Information]

The iSMrc_separate command displays messages when Separate starts, during execution, and when Separate ends.

On the Windows system

[Start message]

```
Separate Start      YYYY/MM/DD hh:mm:ss
MV:disk_number     Id_name      type
    volume_name
    path
RV:disk_number     Id_name      type
    volume_name
    path
```

[Execution message]

Separating...

[End message]

```
Separating Normal End YYYY/MM/DD hh:mm:ss
MV:disk_number     Id_name      type
    volume_name
    path
RV:disk_number     Id_name      type
    volume_name
    path
```

Description

The execution message and the end message appear only when -wait has been specified to wait for the Separated state.

If you do not want the execution message to appear, change the RPL_WAITMSG setting in the replication operation option setting file. Information about the replication operation option setting file, refer to the “Data Replication Command Reference”.

YYYY/MM/DD hh:mm:ss:	Start/End time (Year Month Day Hour Minute Second)
disk_number:	Physical disk number
Id_name:	Logical disk name
type:	OS type
volume_name:	Mount point volume name
path:	Drive letter or path name mounted on the NTFS volume folder accessed by users
Separating...:	The “.” character is dynamically updated until Separate is completed.

On the UNIX system

[Start message]

Separate Start	YYYY/MM/DD hh:mm:ss		
MV:special_file_name	Id_name	type	
RV:special_file_name	Id_name	type	

[Execution message]

Separating...

[End message]

Separate Normal End	YYYY/MM/DD hh:mm:ss		
MV:special_file_name	Id_name	type	
RV:special_file_name	Id_name	type	

Description

The execution message and the end message appear only when -wait has been specified to wait for the Separated state.

If you do not want the execution message to appear, specify the RPL_WAITMSG environment variable. For information about environment variables, refer to the “Data Replication Command Reference”.

YYYY/MM/DD hh:mm:ss:	Start/End time (Year Month Day Hour Minute Second)
special_file_name:	Special file name
Id_name:	Logical disk name
type:	OS type
Separating...:	The “.” character is dynamically updated until Separate is completed.

[Execution Conditions]

To perform Separate, the following conditions must be satisfied.

- (i) The target MV and RV are paired.
- (ii) The target MV or RV has been registered in the volume list.
- (iii) The volume list is not being created or updated.
- (iv) When starting Separate, the file system cache used for MV until the instruction is executed must be flushed or placed in unmount state to complete updating to MV.
- (v) The disk array where the specified MV and RV are stored is not in the Freeze state.
- (vi) The Synchronous state of the target pair is not the Restore execution state.
- (vii) Specifying a volume of a dynamic disk or a GPT-format partition disk is not allowed (Windows only).
- (viii) The iSM dedicated special file is not being created (HP-UX version UNIX only).

- (ix) When an LVM volume group or a VxVM disk group is specified, the target volume group or disk group must be active (UNIX only).
- (x) When specifying the combination of an LVM volume group or a VxVM disk group with a special file name (logical disk name), you must specify the same number of logical volumes that make up the volume group or disk group as MV (RV) on the special file name (logical disk name) side.
In this case, Copy is performed in specified sequential order (UNIX only).

The above execution conditions (ii), (iii), (vii), (viii), (ix), and (x) are not applicable when conducting a joint operation with the iSM (replication management).

Figure 4-27 illustrates the execution conditions of Separate.

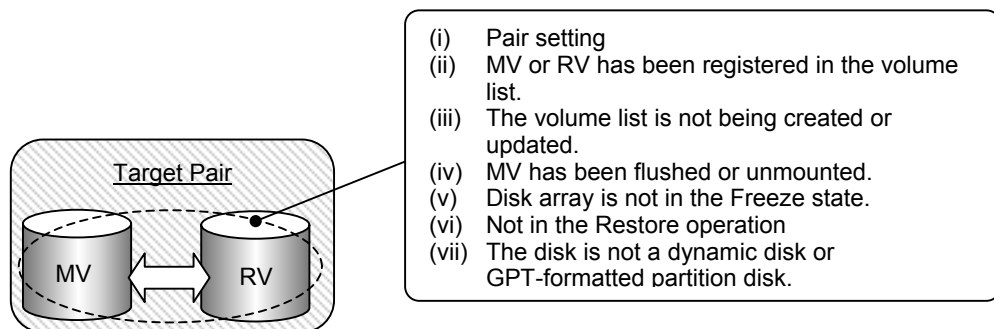


Figure 4-27 Execution Conditions of Separate

4.6.3 Restore Command

For Restore, the iSMrc_restore command is used.

By executing the iSMrc_restore command, copy from RV to the paired MV starts.

Before Restore is performed, MV and RV to be specified must be paired beforehand. In addition, MV and RV to be specified must be registered in the volume list (created by iSMvollist) beforehand.

If RV is used as a file system, the mount of the file system must be canceled before Restore is started.

On the Windows system, unmount the MV and flush the buffer of the file system. Then, mount the MV again after starting Restore. On the UNIX system, if an MV's file system is mounted, Restore does not start resulting in an abnormal end. Therefore, before executing Restore, you must unmount the MV's file system.

[Main Options]

For the iSMrc_restore command, you can specify the following options regarding the Restore operation.

(1) Specifying paired volumes

Specify MV and RV volumes.

- Specify MV (-mv volume -mvflg mv_flg)
Specifies the volume and volume type of MV.
- Specify RV (-rv volume -rvflg rv_flg)
Specifies the volume and volume type of RV.

For information about volume types, refer to 4.3 "Volume Types".

On the Windows system, when a specific partition (drive letter) is specified for a volume consisting of multiple partitions, all partitions in the volume become operation targets; therefore, the default setting does not allow the multiple partitions to be operated. To perform operations for a volume consisting of multiple partitions, you need to change the default setting. For information about the replication operation option setting file, refer to the "Data Replication Command Reference".

(2) Specifying the copy range (-cprange)

Normally, only the difference area (diff) of MV and RV is copied. You can also instruct to copy the entire area (full) explicitly.

(3) Specifying the Copy Control state (-cpmode)

You can specify the Copy Control state in Restore Execution and the Synchronous state.

- Synchronous Copy (-cpmode sync)

Changes the Copy Control state to the Synchronous Copy mode.

- Semi-synchronous Copy (-cpmode semi)

Changes the Copy Control state to the Semi-synchronous Copy mode. This can be specified for paired volumes in different disk arrays.

- Background Copy (-cpmode bg)

Changes the Copy Control state to the Background Copy state.

(4) Specifying the access restrictions for RV (-rvacc)

You can specify the access restrictions for RV in Restore Execution or when Restore is complete.

- Not Ready (-rvacc nr)

Switches to the Not Ready state. Operations cannot be performed for the volume from the system.

- Read Only (-rvacc ro)

For the volume, only Read from the system can be performed.

Pay careful attention when you specify Ready Only (-rvacc ro) for the RV access restrictions.

For details, refer to 2.6 “RV Access Restriction”.

(5) Specifying the wait for copy completion (-wait/nowait)

The system can wait for completion of the command after Restore until the Synchronous state.

- Wait Specified (-wait [second])

If a value is specified in second, the monitoring time interval of the disk array becomes the specified value. The available range is from 1 through 30 seconds (integer). If the value is omitted, the RPL_WATCHDEV setting in the replication operation option setting file is used for Windows while the setting of environment variable RPL_WATCHDEV is used for UNIX. For details on operational settings, refer to the “Data Replication Command Reference”.

- No Wait (-nowait)

Performs only a Restore start instruction and terminates the command. You can check the termination of Restore by the iSMrc_query or iSMrc_wait command.

(6) Specifying an operation mode for RV (-mode)

You can select whether to reflect the updated data of the MV into the RV while performing Restore.

- RV update specified (-mode update)

Performs Restore while reflecting the updated data of the MV into the RV. When Restore is completed and the Synchronous State is placed, the state changes to Synchronous State (rst/sync).

- RV protection specified (-mode protect)

Performs Restore without reflecting the updated data of the MV into the RV. When Restore is completed and the Synchronous State is placed, Separate is automatically executed and then the state changes to Separated State.

- According to the default setting (-mode default)

On the Windows system, the system follows the MODE specification in the replication operation option setting file. On the UNIX system, the system follows the setting of the RPL_SEP_MODE environment variable. For details of each setting, refer to the “Data Replication Command Reference”.

[Displayed Information]

The iSMrc_restore command displays messages when Restore starts, during execution, and when Restore ends.

On the Windows system

[Start message]

iSM13224: MV is restored.

Volume name: volume_name

Mount Point: path

Umount Start YYYY/MM/DD hh:mm:ss

Umount Normal End YYYY/MM/DD hh:mm:ss

Restore Start YYYY/MM/DD hh:mm:ss

MV:disk_number Id_name type

volume_name

path

RV:disk_number Id_name type

volume_name

path

[Execution message]

Restoring...

[End message]

Restore Normal End YYYY/MM/DD hh:mm:ss

MV:disk_number Id_name type

volume_name

path

RV:disk_number Id_name type

volume_name

path

Description

The execution message and the end message appear only when -wait has been specified to wait for the Synchronous State (rst/sync).

If you do not want the execution message to appear, change the RPL_WAITMSG setting in the replication operation option setting file. For information about the replication operation option setting file, refer to the “Data Replication Command Reference”.

YYYY/MM/DD hh:mm:ss:	Start/End time (Year Month Day Hour Minute Second)
disk_number:	Physical disk number
ld_name:	Logical disk name
type:	OS type
volume_name:	Mount point volume name
path:	Drive letter or path name mounted on the NTFS volume folder accessed by users
Restoring...:	The “.” character is dynamically updated until Restore is completed.

On the UNIX system

[Start message]

Restore Start	YYYY/MM/DD hh:mm:ss
MV:special_file_name	ld_name type
RV:special_file_name	ld_name type

[Execution message]

Restoring...

[End message]

Restore Normal End	YYYY/MM/DD hh:mm:ss
MV:special_file_name	ld_name type
RV:special_file_name	ld_name type

Description

The execution message and the end message appear only when -wait has been specified to wait for the Synchronous State (rpl/sync).

If you do not want the execution message to appear, change the setting of the RPL_WAITMSG environment variable. For information about environment variables, refer to the “Data Replication Command Reference”.

YYYY/MM/DD hh:mm:ss:	Start/End time (Year Month Day Hour Minute Second)
special_file_name:	Special file name
ld_name:	Logical disk name
type:	OS type
Restoring...:	The “.” character is dynamically updated until Restore is completed.

[Execution Conditions]

To perform Restore, the following conditions must be satisfied.

- (i) The target MV and RV are paired.
- (ii) The target MV or RV has been registered in the volume list.
- (iii) The volume list is not being created or updated.
- (iv) Both MV and RV are unmounted from the system.
- (v) The disk array where the specified MV and RV are stored is not in the Freeze state.
- (vi) The Activity State of the target pair is Separate. However, Separate is not being executed.
- (vii) When the specified MV is used as the base-volume (BV) of the snapshot function, snapshot is not be established for all the snapshot-volumes (SV) paired with the base-volume.
- (viii) The pair of the specified MV and the paired RV is not in the Separate state.
- (ix) The Activity State of the pair of the specified MV and the paired upper MV is Separate.
- (x) The Activity State of the pair of the specified RV and the paired lower RV is Separate.
- (xi) The Semi-synchronous Copy mode cannot be specified for paired volumes set in the same disk array. The Semi-synchronous Copy mode can be specified only for paired volumes set in different disk arrays.
- (xii) Specifying a volume of a dynamic disk or a GPT-format partition disk is not allowed (Windows only).
- (xiii) The iSM dedicated special file is not being created (HP-UX version UNIX only).
- (xiv) When an LVM volume group or a VxVM disk group is specified, the target volume group or disk group must be active (UNIX only).
- (xv) When specifying the combination of an LVM volume group or a VxVM disk group with a special file name (logical disk name), you must specify the same number of logical volumes that make up the volume group or disk group as MV (RV) on the special file name (logical disk name) side.
In this case, Restoration is performed in specified sequential order (UNIX only).

The above execution conditions (ii), (iii), (xii), (xiii), (xiv), and (xv) are not applicable when conducting a joint operation with the iSM (replication management).

Figure 4-28 illustrates the execution conditions of Restore.

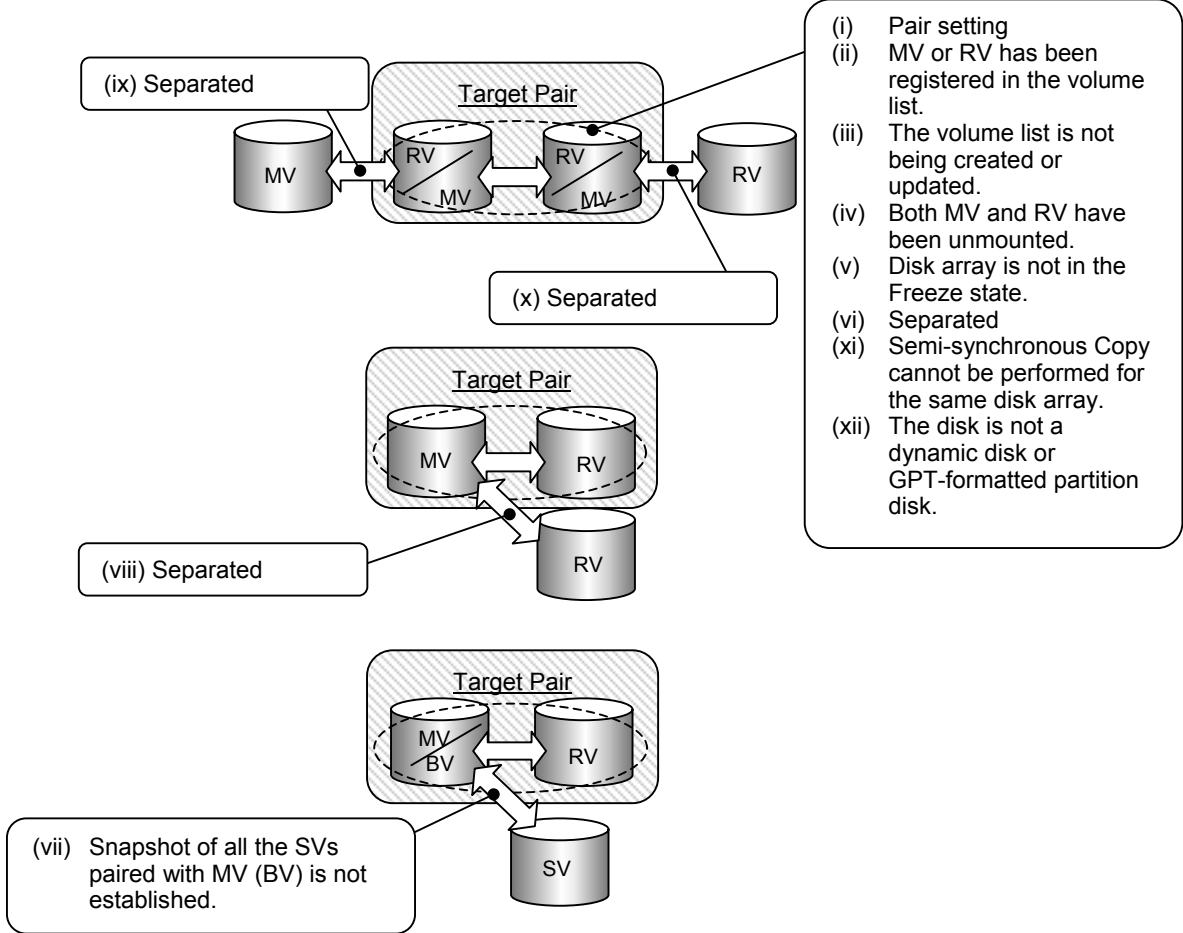


Figure 4-28 Execution Conditions of Restore

4.6.4 Copy Control State Change Command

For changing the Copy Control state, the iSMrc_change command is used.

You can use option specification of the iSMrc_change command to perform the Copy Control state change in the Replicate or Restore state.

Before the Copy Control state is changed, MV and RV to be specified must be paired beforehand. In addition, MV and RV to be specified must be registered in the volume list (created by iSMvollist).

When RV Restore(protect) specified is executed, the updated data of the MV is not reflected into the RV. Therefore, changing a Copy Control state (Synchronous Copy Mode, Semi-synchronous Copy Mode, or Background Copy) has no effect.

[Main Options]

For iSMrc_change command, you can specify the following options for changing the Copy Control state.

(1) Specifying paired volumes

Specify MV and RV volumes.

- Specify MV (-mv volume -mvflg mv_flg)
Specifies the volume and volume type of MV.
- Specify RV (-rv volume -rvflg rv_flg)
Specifies the volume and volume type of RV.

For information about volume types, refer to 4.3 “Volume Types”.

(2) Copy Control State

The following Copy Control State can be specified.

- Synchronous Copy (-sync)
Changes the Copy Control state to the Synchronous Copy mode.
- Semi-synchronous Copy (-semi)
Changes the Copy Control state to the Semi-synchronous Copy mode. This can be specified for paired volumes in different disk arrays.
- Background Copy (-bg)
Changes the Copy Control state to the Background Copy state.
- Suspend (-suspend)
Changes the Copy Control state to the Suspend state.
- Resume (-resume)
Changes the Copy Control state to the Foreground Copy state.

The following table shows the Copy Control state before and after the change is made.

Table 4-5 Relations of Copy Control State

Change Option State before Change	sync (synchronization)	semi (semi-synchronization)	bg (background)	suspend (suspend)	resume (resume)
sync (synchronization)	×	×	○	○	△
semi (semi-synchronization)	×	×	○	○	△
bg (background)	○	○	△	○	○
suspend (suspend)	○	○	○	△	○

○: The state can be changed.

△: The state can be changed, but the Copy Control state cannot be changed.

×: The state cannot be changed.

[Displayed Information]

The iSMrc_change command displays the following message when the Change Copy Control State starts and ends.

On the Windows system

[Start message]

```

Change Start          YYYY/MM/DD hh:mm:ss
    MV:disk_number    Id_name          type
        volume_name
        path
    RV:disk_number    Id_name          type
        volume_name
        path
  
```

[End message]

```

Change Normal End     YYYY/MM/DD hh:mm:ss
    MV:disk_number    Id_name          type
        volume_name
        path
    RV:disk_number    Id_name          type
        volume_name
        path
  
```

Description

YYYY/MM/DD hh:mm:ss: Start/End time (Year Month Day Hour Minute Second)

disk_number: Physical disk number

Id_name: Logical disk name

type: OS type

volume_name: Mount point volume name

path: Drive letter or path name mounted on the NTFS volume folder accessed by users

On the UNIX system

[Start message]

Change Start	YYYY/MM/DD hh:mm:ss		
MV:special_file_name	Id_name	type	
RV:special_file_name	Id_name	type	

[End message]

Change Normal End	YYYY/MM/DD hh:mm:ss		
MV:special_file_name	Id_name	type	
RV:special_file_name	Id_name	type	

Description

YYYY/MM/DD hh:mm:ss: Start/End time (Year Month Day Hour Minute Second)

special_file_name: Special file name

Id_name: Logical disk name

type: OS type

[Execution Conditions]

To perform operations regarding the Copy Control state, the following conditions must be satisfied.

- (i) The target MV and RV are paired.
- (ii) The target MV or RV has been registered in the volume list.
- (iii) The volume list is not being created or updated.
- (iv) The disk array where the specified MV and RV are stored is not in the Freeze state.
- (v) The Activity State of the target pair is Replicate or Restore.
- (vi) The Semi-synchronous Copy mode cannot be specified for paired volumes set in the same disk array. The Semi-synchronous Copy mode can be specified only for paired volumes set in different disk arrays.
- (vii) Changing from Synchronous Copy to Semi-synchronous Copy mode or from Semi-synchronous Copy to Synchronous Copy mode is disabled.
- (viii) Specifying a volume of a dynamic disk or a GPT-format partition disk is not allowed (Windows only).
- (ix) The iSM dedicated special file is not being created (HP-UX version UNIX only).
- (x) When an LVM volume group or a VxVM disk group is specified, the target volume group or disk group must be active (UNIX only).
- (xi) When specifying the combination of an LVM volume group or a VxVM disk group with a special file name (logical disk name), you must specify the same number of logical volumes that make up the volume group or disk group as MV (RV) on the special file name (logical disk name) side.
In this case, Copy is performed in specified sequential order (UNIX only).

The above execution conditions (ii), (iii), (viii), (ix), (x), and (xi) are not applicable when conducting a joint operation with the iSM (replication management).

Figure 4-29 illustrates the execution conditions of operations regarding the Copy Control state.

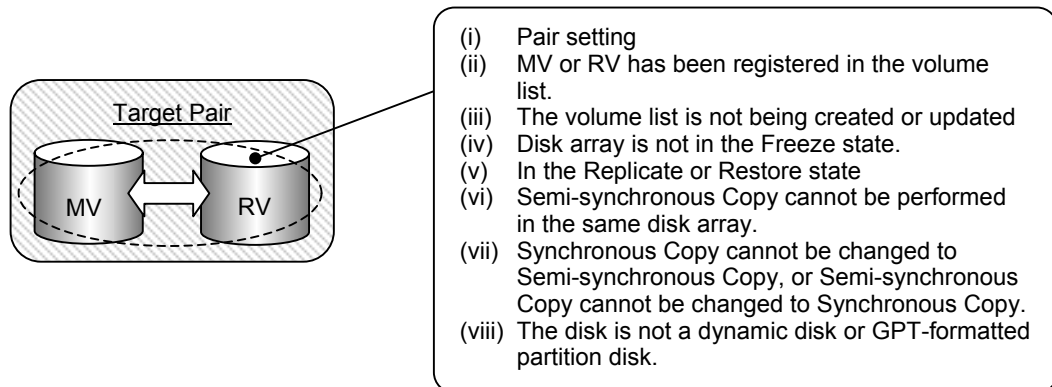


Figure 4-29 Execution Conditions of Copy Control State Operation

4.6.5 Wait Command

Use the iSMrc_wait command to wait for Synchronous State (rpl/sync), Synchronous State (rst/sync), or Separated State.

A pair of MV and RV must be specified as the target volumes beforehand. The MV and RV to be specified must be registered in the Volume List (created by the iSMvollist).

[Main Options]

The iSMrc_wait command enables the specification of the following options for wait operation:

(1) Specifying paired volumes

Specify MV and RV volumes.

- Specify MV (-mv volume -mvflg mv_flg)
Specifies the volume and volume type of MV.
- Specify RV (-rv volume -rvflg rv_flg)
Specifies the volume and volume type of RV.

For information about volume types, refer to 4.3 “Volume Types”.

The target volumes (MV and/or RV) can be specified in any of the combinations below.

- MV and RV
Waits for a specified pair of volumes to enter a target state.
- MV only
When the ratio of MV and RV that is set for MV is 1-to-1, RV can be omitted and the same operation as when MV and RV are specified is performed for this pair.
- RV only
Same operation as when MV and RV are specified

(2) Wait end condition (-cond)

You can specify a condition for ending Wait. This option must be specified.

- Completion of synchronous copy (-cond sync)
Waits for Synchronous State (rpl/sync) or Synchronous State (rst/sync).
- Completion of separation (-cond sep)
Waits for the Separated state (including the Separated state accompanied by completion of Restore(protect)).

(3) Paired-volume state monitoring interval (-interval [second])

You can specify a time interval (in seconds) at which the state of paired volumes is to be monitored.

A value (in seconds) specified for [second] is the monitoring time interval. A value 1 to 30 seconds (integer) can be specified.

On the Windows system, the default value can be specified by using RPL_WATCHDEV in the

replication operation option setting file. On the UNIX system, the default value can be specified by using the RPL_WATCHDEV environment variable. For details of each setting, refer to the “Data Replication Command Reference”.

(4) Paired-volume state monitoring time limit (-limit)

You can specify a time limit for stopping the monitoring of the paired-volume state. If the Wait is not completed before the elapse of the specified time, it is discontinued and the command ends abnormally.

- Time specification (-limit [second])

A value (in seconds) specified for [second] is the monitoring time limit. A value from 0 to 86,400 seconds (integer) can be specified.

- No limit (-limit nolim)

Unlimited wait.

On the Windows system, the default value can be specified by using RPL_LIMWATCHDEV in the replication operation option setting file. On the UNIX system, the default value can be specified by using the RPL_LIMWATCHDEV environment variable. For details of each setting, refer to the “Data Replication Command Reference”.

[Displayed Information]

The iSMre_wait command displays the following message during Wait execution and when Wait ends.

On the Windows system

[Execution message]

Waiting...

[End message]

activity_state	Normal	End	YYYY/MM/DD hh:mm:ss
MV:disk_number	Id_name		type
volume_name			
path			
RV:disk_number	Id_name		type
volume_name			
path			

Description

If you do not want the execution message to appear, change the RPL_WAITMSG setting in the replication operation option setting file. Information about the replication operation option setting file, refer to the “Data Replication Command Reference”.

activity_state:	Activity State of the paired volumes for which the wait command is completed
	Replicate: Synchronous State (rpl/sync)
	Restore: Synchronous State (rst/sync)
	Separate: Separated (including the Separated state accompanied by completion of Restore(protect))
YYYY/MM/DD hh:mm:ss:	Start/End time (Year Month Day Hour Minute Second)
disk_number:	Physical disk number
ld_name:	Logical disk name
type:	OS type
volume_name:	Mount point volume name
path:	Drive letter or path name mounted on the NTFS volume folder accessed by users
Waiting...:	The “.” character is dynamically updated until Wait is completed.

On the UNIX system

[Execution message]

Waiting...

[End message]

activity_state	Normal End	YYYY/MM/DD hh:mm:ss
MV:disk_number	ld_name	type
RV:disk_number	ld_name	type

Description

If you do not want the execution message to appear, change the setting of the RPL_WAITMSG environment variable. For information about environment variables, refer to the “Data Replication Command Reference”.

activity_state:	Activity State of the paired volumes for which the wait command is completed
	Replicate: Synchronous State (rpl/sync)
	Restore: Synchronous State (rst/sync) or rst/sync (protect)
	Separate: Separated
YYYY/MM/DD hh:mm:ss:	Start/End time (Year Month Day Hour Minute Second)
special_file_name:	Special file name
ld_name:	Logical disk name
type:	OS type
Waiting...:	The “.” character is dynamically updated until Wait is completed.

[Execution Conditions]

To execute the wait command, the following conditions must be satisfied:

- (i) The target MV and RV are paired.
- (ii) The target MV or RV has been registered in the volume list.
- (iii) The volume list is not being created or updated.
- (iv) The disk array where the specified MV and RV are stored is not in the Freeze state.
- (v) Specifying a volume of a dynamic disk or a GPT-format partition disk is not allowed (Windows only).
- (vi) The iSM dedicated special file is not being created (HP-UX version UNIX only).
- (vii) When an LVM volume group or a VxVM disk group is specified, the target volume group or disk group must be active (UNIX only).
- (viii) When specifying the combination of an LVM volume group or a VxVM disk group with a special file name (logical disk name), you must specify the same number of logical volumes that make up the volume group or disk group as MV (RV) on the special file name (logical disk name) side.
In this case, Copy is performed in specified sequential order (UNIX only).

The above execution conditions (ii), (iii), (v), (vi), (vii), and (viii) are not applicable when conducting a joint operation with the iSM (replication management).

Figure 4-30 shows the Wait execution conditions.

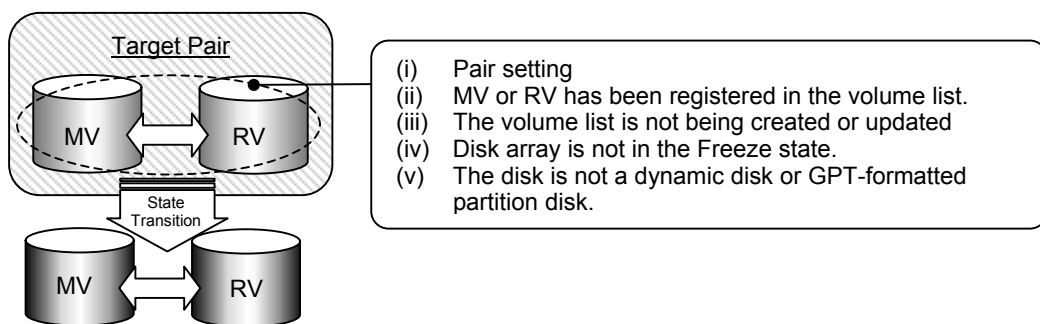


Figure 4-30 Execution Conditions for Wait Command

4.6.6 Replication State Display Command

To display the replication state, the iSMrc_query command is used.

As the target volume, MV and RV to be specified must be paired beforehand. In addition, MV and RV to be specified must be registered in the volume list (created by iSMvollist).

[Main Options]

The iSMrc_query command enables the specification of the following options:

(1) Specifying paired volumes

Specify MV and RV volumes.

- Specify MV (-mv volume -mvflg mv_flg)
Specifies the volume and volume type of MV.
- Specify RV (-rv volume -rvflg rv_flg)
Specifies the volume and volume type of RV.

For information about volume types, refer to 4.3 “Volume Types”.

The target volumes (MV and/or RV) can be specified in any of the combinations below.

- MV and RV
Waits for a specified pair of volumes to enter a target state.
- MV only
Waits for all the pairs set with MV to enter a target state.
- RV only
Same operation as when MV and RV are specified

[Displayed Information]

The iSMrc_query command displays the following information.

On the Windows system

[Displayed information]

MV: Disk No.	disk_number
LD Name	ld_name
Type	type
Volume Name	volume_name
Path	path
RV: Disk No.	disk_number
LD Name	ld_name
Type	type
Volume Name	volume_name
Path	path
Activity State	activity

Synchronous State	sync
Copy Control State	copy
<state> Start Time	YYYY/MM/DD hh:mm:ss
<state> End Time	YYYY/MM/DD hh:mm:ss
Separate Diff	separate_diffsize
Copy Diff	copy_diffsize
RV Access	rvacc
Previous Active	prev_state

Description

disk_number:	Physical disk number
ld_name:	Logical disk name
type:	OS type
volume_name:	Mount point volume name
path:	Drive letter or path name mounted in the NTFS folder
activity:	Activity State
sync:	Paired operation state
copy:	Copy Control State
<state> Start Time:	Operation start time (<state> varies)
<state> End Time:	Operation end time (<state> varies)
separate_diffsize:	Difference of copy occurred in the Separate state
copy_diffsize:	Difference of copy occurred in the Replicate or Restore state
rvacc:	Access restrictions for RV
prev_state:	Paired operation state before the state transition

On the UNIX system

[Displayed information]

MV: Special File	special_file_name
LD Name	ld_name
Type	type
RV: Special File	special_file_name
LD Name	ld_name
Type	type
Activity State	activity
Synchronous State	sync
Copy Control State	copy
<state> Start Time	YYYY/MM/DD hh:mm:ss
<state> End Time	YYYY/MM/DD hh:mm:ss
Separate Diff	separate_diffsize
Copy Diff	copy_diffsize
RV Access	rvacc

Previous Active prev_state

Description

special_file_name:	Special file name
ld_name:	Logical disk name
type:	OS type
activity:	Activity State
sync:	Paired operation state
copy:	Copy Control State
<state> Start Time:	Operation start time (<state> varies)
<state> End Time:	Operation end time (<state> varies)
separate_diffsize:	Difference of copy occurred in the Separate state
copy_diffsize:	Difference of copy occurred in the Replicate or Restore state
rvacc:	Access restrictions for RV
prev_state:	Paired operation state before the state transition

[Execution Conditions]

To perform state display, the following conditions must be satisfied.

- (i) The target MV and RV are paired.
- (ii) The target MV or RV has been registered in the volume list.
- (iii) The volume list is not being created or updated.
- (iv) Specifying a volume of a dynamic disk or a GPT-format partition disk is not allowed (Windows only).
- (v) The iSM dedicated special file is not being created (HP-UX version UNIX only).
- (vi) When an LVM volume group or a VxVM disk group is specified, the target volume group or disk group must be active (UNIX only).
- (vii) When specifying the combination of an LVM volume group or a VxVM disk group with a special file name (logical disk name), you must specify the same number of logical volumes that make up the volume group or disk group as MV (RV) on the special file name (logical disk name) side.
In this case, Copy is performed in specified sequential order (UNIX only).

The above execution conditions except for (i) are not applicable when conducting a joint operation with the iSM (replication management).

Figure 4-31 shows execution conditions for displaying the replication state.

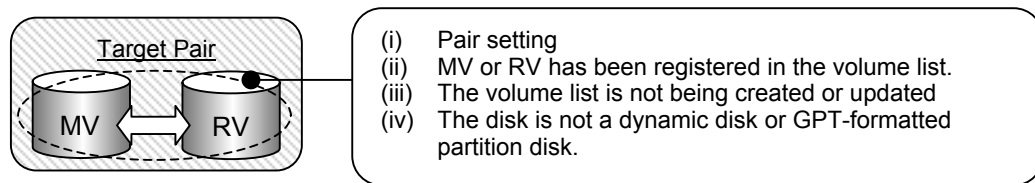


Figure 4-31 Displaying Replication State

4.6.7 Specific Volume Name Display Command

To carry out a specific volume name display, the iSMrc_sense command is used.

The volume to be specified must be registered in the volume list (created by iSMvollist).

[Main Options]

The iSMrc_sense command enables the specification of the following options:

(1) Specifying volumes

Specify the target volume.

- Specify volumes (-vol volume -volflg mv_flg)

Specifies the volume and volume type.

For information about volume types, refer to 4.3 “Volume Types”.

(2) Displaying attribute information (-attr)

Displays the logical disk attributes and the link state of the link-volume (LV) for the data replication and snapshot functions.

[Displayed Information]

The iSMrc_sense command displays the following information:

On the Windows system

[Displayed information]

Disk No.	disk_number
LD Name	ld_name
VAA	vaa
Type	type
Volume Name	volume_name
Path	path
Attribute	attribute
LV Link Status	link_status

Description

disk_number:	Physical disk number
ld_name:	Logical disk name
vaa:	VAA (Volume Absolute Address)
type:	OS type
volume_name:	Mount point volume name
path:	Drive letter or path name mounted on the NTFS volume folder accessed by users

attribute:	Logical disk attribute for the data replication and snapshot functions Displays only when the -attr option is specified.
link_status:	Link state of the link-volume Displays only when the -attr option is specified. When the target volume is not a link-volume, “-” (hyphen) appears.
link	Connected
unlink	Unconnected

On the UNIX system

[Displayed information]

Special file	LD Name	VAA	Type	Attribute	LV Link Status
special_file_name	ld_name	vaa	type	attribute	link_status

Description

special_file_name:	Special file name
ld_name:	Logical disk name
vaa:	VAA (Volume Absolute Address)
type:	OS type
attribute:	Logical disk attribute for the data replication and snapshot functions Displays only when the -attr option is specified.
link_status:	Link state of the link-volume Displays only when the -attr option is specified. When the target volume is not a link-volume, “-” (hyphen) appears.
link	Connected
unlink	Unconnected

[Execution Conditions]

To display a specific volume name, the following conditions must be satisfied.

- (i) The target volume or the volume paired with the target volume has been registered in the volume list.
- (ii) The volume list is not being created or updated.
- (iii) Specifying a volume of a dynamic disk or a GPT-format partition disk is not allowed (Windows only).
- (iv) The iSM dedicated special file is not being created (HP-UX version UNIX only).
- (v) When an LVM volume group or a VxVM disk group is specified, the target volume group or disk group must be active (UNIX only).

The above execution conditions are not applicable when conducting a joint operation with the iSM (replication management).

Figure 4-32 shows execution conditions for displaying a specific volume name.

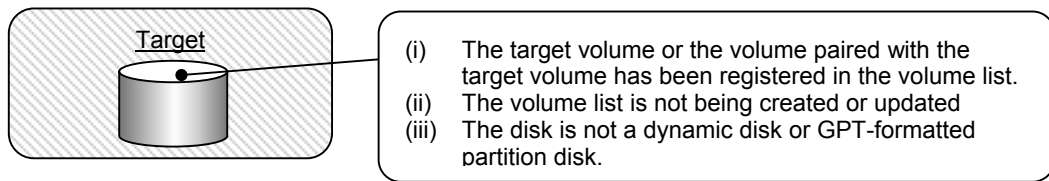


Figure 4-32 Displaying Specific Volume Name

4.7 Pair Setting and Unpair Operations

Pair operation commands make functions available for listing logical disks, pair setting and unpairing. Pair operation enables data replication that changes or switches RVs dynamically.

4.7.1 Logical Disk Information Display Command

To perform logical disk information display, the iSMrc_Idlist command is used. The iSMrc_Idlist command targets disk arrays that are recognized by the system and obtains and displays logical disks and associated information.

[Main Options]

The iSMrc_Idlist command enables the specification of the following options:

- -a option
Lists information of the logical disks stored in all disk arrays.
- -d option
Lists information of disk arrays that are recognized by the system.
- -de option
Lists information of the logical disks stored in the specified disk array. If a specific logical disk name is specified, only information of the specified logical disk name is displayed.
- -cr option
Updates the latest information by re-obtaining information of disk arrays and logical disks that are connected to the system. This option can be used only when the replication management (controlling the I/O issuance to disk arrays via the iSM) is simultaneously conducted.

[Displayed Information]

- (1) When the -a option or the -de option is specified:
Logical disk information as shown below is listed.

Receiving...

```
-----
[Disk Array Name](Management)
LDN      OS Type   LD Name                      Attribute      Capacity
-----
[disk_array_name](management)
ldn       type      ld_name                      attribute      capacity
```

Description

Receiving...: Message indicating that data is being received.
During a joint operation with replication management, this message is displayed until data has been received. While data is being received, the “.” character is updated.

disk_array_name: Disk array name

management: Identifies whether the system recognizes the disk array.
direct Disk array directly recognized by the system.
indirect Disk array which is not recognized by the system

type: OS type

ldn: Logical disk number

ld_name: Logical disk name

attribute: Logical disk attribute for the data replication and snapshot functions

capacity: Logical disk capacity

- (2) When the -d option is specified:
Logical disk information as shown below is listed.

Receiving...

```
-----
Disk Array Name                Management
-----
disk_array_name                management
```

Description

Receiving...	Message indicating that data is being received. During a joint operation with replication management, this message is displayed until data has been received. While data is being received, the “.” character is updated.
disk_array_name	Disk array name
management	Identifies whether the system recognizes the disk array. direct Disk array directly recognized by the system indirect Disk array which is not recognized by the system

[Execution Conditions]

To display the information of logical disks, the following conditions must be satisfied.

- (i) The logical disk attribute indicating the reserve attribute is not displayed.
- (ii) The logical disk attribute indicating the snapshot data volume (SDV) of the snapshot function is not displayed.
- (iii) At least one logical disk of the target disk array is registered in the volume list.
- (iv) The volume list is not being created or updated.
- (v) The iSM dedicated special file is not being created (HP-UX version UNIX only).

The above execution conditions except for (i) and (ii) are not applicable when conducting a joint operation with the iSM (replication management).

4.7.2 Pair/Unpair Command

To execute pair setting or unpair, the iSMrc_pair command is used.

The iSMrc_pair command sets and unpairs specified paired MV and RV. If a failure occurred on the MV side or RV side disk array and the regular unpairing becomes impossible, Forced Unpair can be performed.

[Main Options]

The iSMrc_pair command enables the specification of the following option regarding pair setting and unpairing.

- (1) Specifying pair setting (-pair) or unpairing (-unpair)

Specify whether to set a pair or unpair.

- Specify a pair (-pair)
Specifies pair setting for specified paired volumes.
- Unpair (-unpair)
Unpair the specified paired volumes.

- (2) Specifying paired volumes

Specify MV and RV volumes.

- Specify MV (-mv volume -mvflg mv_flg)
Specifies the volume and volume type of MV.
- Specify RV (-rv volume -rvflg rv_flg)
Specifies the volume and volume type of RV.

The pair setting and canceling operation (iSMrc_pair command) is performed on a single logical disk; therefore, it is not possible to specify an LVM volume group or a VxVM disk group as a volume. For details of the volume types, refer to 4.3 “Volume Types”.

On the Windows system, when a specific partition (drive letter) is specified for a volume consisting of multiple partitions, all partitions in the volume become operation targets; therefore, the default setting does not allow the multiple partitions to be operated. To perform operations for a volume consisting of multiple partitions, you need to change the default setting. For information about the replication operation option setting file, refer to the “Data Replication Command Reference”.

(3) Forced Unpair (-force)

If the regular unpairing becomes impossible due to a failure occurred in the connections between disk arrays and the like, it is possible to perform Forced unpair for MV and RV individually by specifying the -force option.

You can specify one of the following as a Forced Unpair target.

- Perform Forced Unpair for both MV and RV. (-force all)
- Perform Forced Unpair only for MV. (-force mv)
- Perform Forced Unpair only for RV. (-force rv)

Note the following when performing Forced Unpair.

- When MV and RV are in the same system, execute the “all” specification.
- When MV and RV are in different systems, use Forced Unpair by specifying MV or RV.
- When performing Forced Unpair by using MV specification (or RV specification), after removing the cause of the failure, you must perform Forced Unpair for the other volume.
- If Forced Unpair is performed for either MV or RV, subsequent replication operations will not function properly because inconsistency occurs in the recognized states of MV and RV.

[Displayed Information]

When the pair setting and unpairing has been successfully performed by the iSMrc_pair command, the following message appears.

iSM13247: Command has completed successfully. (code=pppp-xxxx-xxxx-xxxx)

Description

pppp:	Process number
xxxx:	Detailed information (code value for maintenance)

[Execution Conditions]

To set or unpair, the following conditions must be satisfied:

- (i) The target MV or RV is registered in the volume list.
- (ii) The disk array where the specified MV and RV are stored is not in the Freeze state.
- (iii) When setting a pair, the MV's and RV's logical disk capacity and OS type must coincide.
- (iv) The RV to be set as a pair should not be paired with another volume.
- (v) To release a pair, the target MV and RV are set as a pair.
- (vi) To release a pair, the operational state of the target pair is the Separated state.
- (vii) Logical disks are not registered in the reservation group.
- (viii) A volume is not the link-volume (LV) of the snapshot function.
- (ix) A volume is not the snapshot-volume (SV) and snapshot data volume (SDV) of the snapshot function.
- (x) The base-volume (BV) of the snapshot function is not used as RV.

- (xi) The volume list is not being created or updated.
- (xii) Specifying a volume of a dynamic disk or a GPT-format partition disk is not allowed (Windows only).
- (xiii) The iSM dedicated special file is not being created (HP-UX version UNIX only).

The above execution conditions (ii), (xi), (xii), and (xiii) are not applicable when conducting a joint operation with the iSM (replication management).

4.8 Disk Array Operations

The disk array operation command provides the function of displaying information on the replication function of a disk array.

4.8.1 Command for Displaying Information on the Replication Function

To display information on the replication function of a disk array, use the `iSMrc_arrayinfo` command. The `iSMrc_arrayinfo` command obtains and displays information related to the replication function of the disk array recognized by the system.

[Main Options]

The following options can be used with the `iSMrc_arrayinfo` command to display information related to the replication function.

- Displaying set information (-dinfo)
Obtains and displays the disk array settings related to the replication function.
- Displaying link information (-linfo)
Obtains and displays how disk arrays having the RemoteDataReplication function are connected each other and the status of link paths.

[Displayed Information]

- (1) When the -dinfo option is specified

Information on the replication function of a disk array is displayed as shown below.

Disk Array Name	disk_array_name
SAA	saa
Differential Map	diff_map
Replication Status	replication_status
Back Ground Copy Level	bgcopy_level
Max Number of RV Setting	rv_setting

Description

disk_array_name:	Disk array name
saa:	SAA (Subsystem Absolute Address) Indicates a unique value that identifies a disk array.
diff_map:	Installation of Differential Map Indicates whether the difference management function, which holds the update difference between MV and RV, is present. <ul style="list-style-type: none"> Build: Differential Map is installed. Not Build: Differential Map is not installed.
replication_status:	Status of the replication function of a disk array <ul style="list-style-type: none"> Ready: The function is available. Freeze: The function is unavailable. The replication function of the disk array freezes or the disk array is OFF.
bgcopy_level:	Background copy level Indicates the priority of Background Copy.
rv_setting:	Maximum number of RVs that can be set Indicates the maximum number of RVs that can be set for one MV.

- (2) When the -linfo option is specified

How disk arrays are connected each other and the status of link paths are displayed. When multiple paths are connected or multiple disk arrays are linked, all information on the link paths is displayed.

Link Disk Array Name	disk_array_name
Link No	link_number
Path No	path_number
Path State	path_state
Director No	director_number

Description

disk_array_name:	Name of the disk array to link to
link_number:	Link number Number of a disk array to link to (link number), beginning with 0
path_number:	Path number Connection number for each of disk arrays to link to, beginning with 0
path_state:	Path status Indicates the connection status for each path indicated by the path number. <ul style="list-style-type: none">• Ready: Link normal• Fault: Link abnormal• Freeze: Replication function of disk array to link to freezing• Offline: Link status unknown (disk array starting)• Link Check: The link status involved in abnormal occurrence being checked
director_number:	Director number Number of the replication director or host director to which the path indicated by a path number is connected

[Execution Conditions]

To display information on the replication function of a disk array, the following conditions must be satisfied.

- (i) At least one logical disk of the target disk array is registered in the volume list.
- (ii) The volume list is not being created or updated.
- (iii) A special file specific to iSM is not being created (HP-UX version UNIX only).

The above execution conditions are not applicable when cooperation with iSM (replication management) is performed.

4.9 Disk Operations

The disk operation function, which functions only on the Windows system, enables disks to be controlled and operated so as to operate the data replication and snapshot functions on the Windows system.

Disk operation commands provide functions necessary for Windows disk operation linking with the replication operation commands or snapshot operation commands rather than a function that replaces Windows “Disk Management”. By using disk operation commands together with replication operation commands or snapshot operation commands on the Windows system, you can easily conduct operation that is comparable to the operation conducted on UNIX.

4.9.1 File System Flush Command

To carry out a file system flush, the iSMrc_flush command is used.

The iSMrc_flush command flushes the file system without unmounting the association of a drive letter and volume, and writes the data in the file system buffer, which has not been reflected to the disk.

When you execute this command, you can reflect data to the disk without quitting the application.

This command executes Flush in units of volumes and flushes only Windows file systems so that other volumes or applications handling their own cache control are not affected. To flush application data, you also need to use the flush process specific to the application.

[Main Options]

For the iSMrc_flush command, the target volume is specified by its drive letter, mount point volume name, or NTFS folder name.

[Displayed Information]

The iSMrc_flush command displays the following messages when Flush starts and ends.

[Start message]

Flush Start	YYYY/MM/DD hh:mm:ss
disk_number	ld_name type
volume_name	
path	

[End message]

Flush Normal End	YYYY/MM/DD hh:mm:ss
disk_number	ld_name type
volume_name	
path	

Description

YYYY/MM/DD hh:mm:ss:	Start/End time (Year Month Day Hour Minute Second)
disk_number:	Physical disk number
ld_name:	Logical disk name
type:	OS type
volume_name:	Mount point volume name
path:	Drive letter or path name mounted on the NTFS volume folder accessed by users

[Execution Conditions]

To perform Flush, the following conditions must be satisfied.

- (i) The target volume is registered in the volume list.
- (ii) The target volume is in the Read/Write-available state.
- (iii) Specifying a volume of a dynamic disk or a GPT-format partition disk is not allowed.
- (iv) The specified file system is mounted.
- (v) This command flushes only the Windows file systems so that the data of applications handling their own cache cannot be flushed. To flush application data to the disk, you need to flush application data first, and then execute the Flush command to flush the file system.

4.9.2 Volume Mount Command

To carry out a volume mount, the iSMrc_mount command is used.

The iSMrc_mount command associates volumes (partitions) and file systems. Mounting allows volumes to be used as file systems (local disks such as C: and D:) on the Windows system.

When the iSMrc_umount command unmounts a volume that is set in the Not Ready state, release the Not Ready state and mount the volume.

[Main Options]

For the iSMrc_mount command, the target volume is specified by its drive letter, mount point volume name, or NTFS folder name.

When you mount a volume with the mount point volume name specified, you can also specify mount point (drive letter or NTFS folder name) at the same time. To mount a volume, set the specified drive letter or NTFS folder to the target volume.

[Displayed Information]

The iSMrc_mount command displays messages when Mount starts and ends.

[Start message]

```
iSMrc_mount: Info:      iSM13220: Setting drive letter (drive:) (volume_name) has
                        succeeded.

Mount Start            YYYY/MM/DD hh:mm:ss
  disk_number          Id_name              type
  volume_name
  path
iSMrc_mount: Info:      iSM13220: Setting drive letter (drive:) (volume_name) has
                        succeeded.
```

[End message]

```
Mount Normal End      YYYY/MM/DD hh:mm:ss
  disk_number          Id_name              type
  volume_name
  path
```

Description

iSM13220: Setting drive letter (drive:) (volume_name) has succeeded.

Message output when a drive letter or an NTFS folder name is set

YYYY/MM/DD hh:mm:ss: Start/End time (Year Month Day Hour Minute Second)

disk_number: Physical disk number

Id_name: Logical disk name

type: OS type

volume_name:	Mount point volume name
path	Drive letter or path name mounted on the NTFS volume folder accessed by users

iSM13220: Setting drive letter (drive:) (volume_name) has succeeded.
Message output when a drive letter or an NTFS folder name is set

[Execution Conditions]

To perform Mount, the following conditions must be satisfied.

- (i) The target volume is registered in the volume list.
- (ii) The target volume is in the Read/Write-available state or is a volume changed to the Not Ready state when the iSMrc_umount command unmounts the volume.
- (iii) Specifying a volume of a dynamic disk or a GPT-format partition disk is not allowed.

4.9.3 Volume Unmount Command

To unmount a volume, the iSMrc_unmount command is used.

The iSMrc_unmount command cancels the association of volumes (partitions) with file systems.

Unmounting a volume flushes the file system buffer of the specified volume thoroughly.

When access is made to the file system of the unmounted volume, the Windows system mounts the volume automatically. When the Windows system mounts a volume automatically, unmount operation is disabled. Note that the file system may be damaged if unintended data is left in the file system buffer due to this operation.

To suppress an unexpected automatic mount, use the **-offline** option. When the **-offline** option is specified, the mount point (drive letter or NTFS folder name) set in the target volume is deleted automatically and the volume is unmounted with the automatic mount suppressed. At this time, Windows 2000 changes the access restriction of the disk (logical disk) to the Not Ready state.

If the **-offline** option is omitted, when the volume to be unmounted is LV, it operates in the same way as the **-offline** option is specified. When the volume to be unmounted is RV, it operates in accordance with the UMOUNT_RVACC parameter setting of the replication operation option setting file.

[Main Options]

For the iSMrc_unmount command, the target volume is specified by its drive letter, mount point volume name, or NTFS folder name. The following option can be specified.

- Forced Unmount (-force)

Even when the volume to be unmounted cannot be locked, it is unmounted forcibly.

- Deleting Mount Point (-offline)

Deletes the mount point and puts the volume in the state where the volume cannot be mounted automatically. In addition, even when the volume to be unmounted cannot be locked, the volume is unmounted forcibly.

[Displayed Information]

The iSMrc_unmount command displays the following messages when Unmount starts and ends.

[Start message]

```
iSMrc_unmount: Info:      iSM13221: Resetting drive letter (drive:) (volume_name) has
                           succeeded.
```

```
Umount Start             YYYY/MM/DD hh:mm:ss
```

```
    disk_number           Id_name           type
```

```
    volume_name
```

```
    path
```

```
iSMrc_unmount: Info:      iSM13221: Resetting drive letter (drive:) (volume_name) has
                           succeeded.
```

[End message]

```
Umount Normal End    YYYY/MM/DD hh:mm:ss
    disk_number      Id_name          type
    volume_name
    path
```

Description

iSM13221: Resetting drive letter (drive:) (volume_name) has succeeded.

Message output when a drive letter or an NTFS folder name is deleted automatically

YYYY/MM/DD hh:mm:ss: Start/End time (Year Month Day Hour Minute Second)

disk_number: Physical disk number

Id_name: Logical disk name

type: OS type

volume_name: Mount point volume name

path: Drive letter or path name mounted on the NTFS volume folder accessed by users

iSM13221: Resetting drive letter (drive:) (volume_name) has succeeded.

Message output when a drive letter or an NTFS folder name is deleted automatically

[Execution Conditions]

To perform Unmount, the following conditions must be satisfied.

- (i) The target volume is registered in the volume list.
- (ii) The target volume is in the Read/Write-available state.
- (iii) Specifying a volume of a dynamic disk or a GPT-format partition disk is not allowed.
- (iv) When the volume to be unmounted is being used by another application, unmount operation may be terminated abnormally. In this case, to cancel reference or update by another application forcibly, execute the CHKDSK command with /F /X specified.
- (v) On Windows 2000, when the **-offline** option is specified, or if the volume to be unmounted is LV, the access restriction of the disk (logical disk) is changed to in the Not Ready state. Therefore, if a volume on the disk with multi-partition configuration is unmounted, pay attention to the operation procedures because all volumes (partitions) on the target disk are in the state where reference and update are disabled.
- (vi) If the **-offline** option is specified, or if the volume to be unmounted is LV, only one mount point (drive letter or NTFS folder name) needs to be set in the target volume. The volume to which no mount point is set or multiple mount points are set cannot be unmounted.

4.9.4 Disk Signature Operation Command

For the disk signature operations, the iSMrc_signature command is used.

A disk signature is system information used for identifying the disk on the Windows system. On the Windows system, two disks with the same signature cannot be used in the same system. For example, Data replication automatically avoids the same disk signature when MV and RV are synchronized. If a failure occurs during replication operations, a conflict may occur in the disk signatures of MV and RV. In such a case, you can use the Disk Signature operation command to restore them. To perform the disk signature operation, you can specify the disk number to operate in units of disks, or you can operate all disks as targets.

[Main Options]

For the iSMrc_signature command, you can specify the following options regarding Disk Signature operation.

- Saving signature (-read)
Saves the disk signature recognized by the Windows system. Signatures are recorded in the signature map file managed by the iSMrc_signature command.
- Writing signature (-set)
Restores the signature saved in the map file to the disk.
- Deleting signature (-del)
Deletes the signature saved in the map file.
- Initializing signature (-init)
Initializes the signature of the physical disk.
- Displaying the list of signature information (-list)
Displays a list of signatures saved in the map file and those saved in the disk array or displays the signatures of the specified physical disk.
- Exporting signature to a file (-export)
Writes the signature information to the specified file.
- Importing signature from a file (-import)
Reads and registers the signature information recorded in the specified file.

[Displayed Information]

The following information is displayed in the signature information list of the iSMrc_signature command.

[Displayed information]

Disk Array Name	Disk No.	Map LDN	Disk Signature	Saved Signature	Attribute	LV Link Status
-----	----	----	-----	-----	-----	-----
disk_array_name	dskn	ldn	map_sig	disk_sig	saved_sig	attribute

Description

disk_array_name:	Disk array name
dskn:	Physical disk number
ldn:	Logical disk number (in hexadecimal)
map_sig:	Reads and displays signature information saved in the map file by the -read option
disk_sig:	Displays signature information read from the physical disk directly.
saved_sig:	Displays signature information saved in the disk array.
attribute:	Displays the logical disk attribute for the data replication and snapshot functions.
link_status:	Displays the link state when the target physical disk is the link-volume (LV) used for the snapshot function. Displays “-” (hyphen), unless the target is a link-volume.
	link Connected
	unlink Unconnected

[Execution Conditions]

To perform Disk Signature operation, the following conditions must be satisfied.

- (i) The target physical disk is registered in the volume list.
- (ii) The target physical disk is not “Not Ready”.
- (iii) Specifying a volume of a dynamic disk or a GPT-format partition disk is not allowed.

4.9.5 Devices Scan Command

To scan devices, the iSMrc_scan command is used.

Executing the iSMrc_scan command scans devices and lets the system recognize available devices.

When the system is starting up with the devices not connected to the system or in “Not Ready” state, the system cannot recognize those devices. For example, a server using RV is restarted in the state where the RV is put in the Not Ready state by replication operation, the RV is not recognized by OS. In this case, to make OS recognize the RV, separate the pair and put the RV in the Read/Write-available state, then execute the command.

If the device access restriction is changed to the Not Ready state by unmount of the iSMrc_umount command, release the Not Ready state to scan the device.

Executing this command has the same effect as “Rescan Disks” by the “Disk Management” function of Windows. Instead of using this command, the devices can be recognized by the “Disk Management” function of Windows.

[Main Options]

The iSMrc_scan command requires no options.

[Displayed Information]

When the iSMrc_scan command is executed, the following message appears.

The iSMrc_scan command may take tens of seconds to complete the operation.

[Start message]

Scan Start	YYYY/MM/DD hh:mm:ss
------------	---------------------

[End message]

Scan Normal End	YYYY/MM/DD hh:mm:ss
-----------------	---------------------

Description

YYYY/MM/DD hh:mm:ss:	Start/End time (Year Month Day Hour Minute Second)
----------------------	--

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